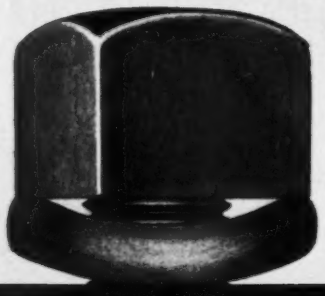
One MACK SWITCH POINT PROTECTOR

LENGTHENS THE LIFE OF A SWITCH RAIL 8 TO 10 TIMES!

Because MACK SWITCH POINT PROTECTORS *are* *Reversible!*

MAINTENANCE EQUIPMENT CO.
Railway Exchange Bldg., Chicago, Illinois

Springlocks—A NEW HY-CROME PRODUCT



The HY-CROME *Springlocks* illustrated in above positions, provide equal tension under the nut and adequate automatic protection from looseness.

HY-CROME *Springlocks*, when tested to A.R.E.A. Specifications, show very high reactive values. No increase in bolt length necessary.

HY-CROME
Springlocks
PATENT APPLIED FOR

A nut or bolt installed without a spring washer eventually becomes loose because of inevitable wear. Only minute wear makes a tightly assembled bolt or nut loose.

The HY-CROME *Springlock* shown below, fully compressed, maintains a constant tension and automatically compensates for wear developing between maintenance periods.

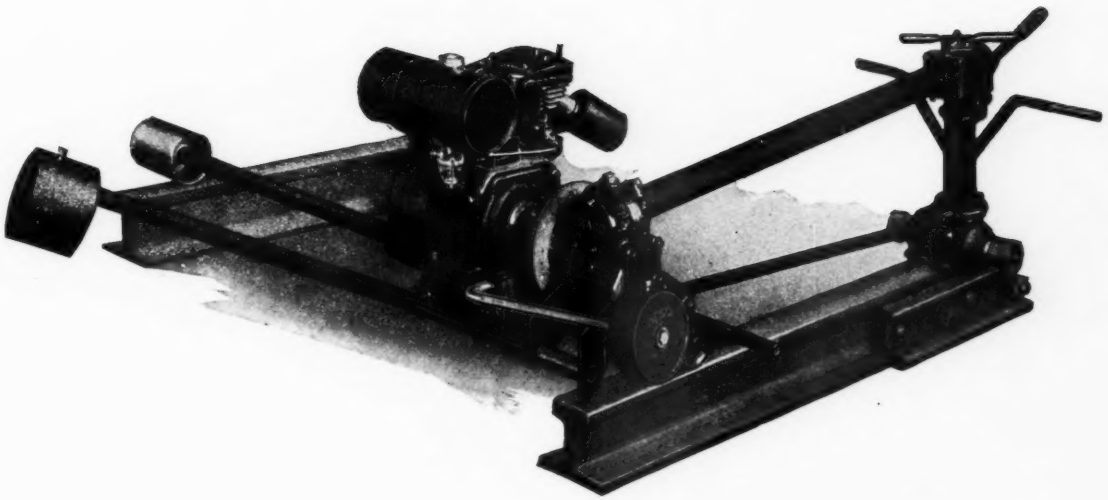
EATON MANUFACTURING COMPANY

RELIANCE SPRING WASHER DIVISION

MASSILLON, OHIO

Sales Offices: New York, Cleveland, Detroit, Chicago, St. Louis, San Francisco, Montreal

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933 at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.



The light, strong, easily handled

RACO POWER TRACK MACHINE

The choice of **50 Roads,** including the largest systems, RACO has to have **obvious superiority.**

A wrecked machine may be **more** than a lost investment.

Two men can remove the RACO from the track in **five seconds.**
One man can tip the RACO from the rails in **three seconds.**

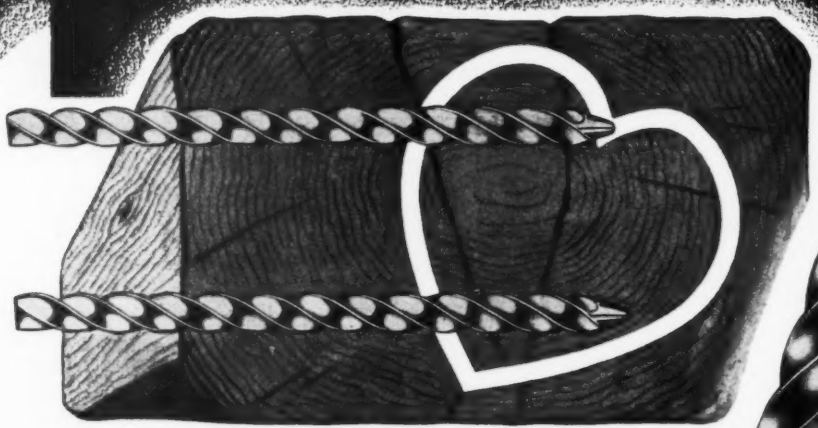
The most **mobile** machine is the **fastest** machine. Out of face tightening is **80% of the work required** of a bolting machine.

On this work, over the long stretches, the RACO **proves its speed and economy.**

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE
405 LEXINGTON AVENUE
(Chrysler Building)
NEW YORK

DRIVE STRAIGHT TO THE HEART OF YOUR COSTLY TIE SPLITTING PROBLEMS



Giant-Grip

REINFORCING DRIVE DOWELS

U. S. PATENT No. 2,014,892

Join the many economy-wise railroad engineers who are saving thousands in split tie rejections and replacements through the use of these patented spiral steel dowels. They definitely prevent splitting in new ties . . . provide the ideal method of salvaging ties already split in service . . . help materially in holding the spikes making them harder to loosen and pull out, and last but not least, their installation is both easy and inexpensive.

Enthusiastic comments by leading railroad engineers conclusively prove the outstanding merit of Giant-Grip Dowels in all kinds of service. Send for samples and see for yourself how ideally they solve the tie splitting problem.

SIZES
Available in all diameters ¼ to ⅞". Any required length.

PITTSBURGH
SCREW AND BOLT CORPORATION
PITTSBURGH, PA.

GARY
SCREW AND BOLT COMPANY
GARY, IND.—CHICAGO, ILL.

American Equipment Corp. . . . . Norristown, Pa.

DISTRICT OFFICES: International Building, New York, N. Y. . . . General Motors Building, Detroit, Michigan . . . . . N. B. C. Building, Cleveland, Ohio . . . Post Office Box 222, Savannah, Georgia . . . Republic Bank Building, Dallas, Texas

Years Ahead in Design

FAIRMONT CARS HAVE THE FEATURES WHICH SERVE YOU BEST

Performance ON THE JOB COUNTS

Fairmont HY-LOAD CRANKSHAFT BEARINGS HAVE *40% More Load Capacity*

The durability of the Fairmont cars and the ease with which they can be maintained have always been an important reason why more than half of the cars in service today are Fairmonts. The new Fairmont Hy-Load Crankshaft Bearing announced in 1938 after three years of testing and research has 40% greater load capacity than is possible with bearings of the ball type and is easier to service. Three of these Hy-Load Crankshaft Bearings support the crankshaft of Fairmont 5 to 8 H.P. and 8 to 13 H.P. roller bearing engines and assure perfect alignment, smooth operation and long, economical performance. The stronger support results in the reduction of vibration and friction and adds years of service to all wearing parts. Time out for servicing is reduced to the minimum; and when it does become necessary it can be done quickly in the field. The Fairmont Hy-Load Crankshaft Bearing is only one of many advanced features that contribute to the superior economy of Fairmont cars.

FAIRMONT RAILWAY MOTORS, INC., FAIRMONT, MINNESOTA

OF ALL THE CARS IN SERVICE TODAY *More Than Half are Fairmonts*

Save 2-Ways ON TRACK MAINTENANCE

WOOLERY TIE CUTTER ON THE JOB

Old ties are quickly cut into 3 pieces BEFORE removal. Each cut is made in 30 seconds or less. The end sections are then pried out, using the center section as a heel. The center section is next lifted out *without disturbing ballast*. Tie bed is shaved down so new tie will just go in. Trenching is eliminated, the solidity of road bed is preserved and the entire job done easier—faster—cheaper.

WOOLERY TIE CUTTER

SAVES 30% OR MORE ON TIE REPLACEMENT COSTS

This revolutionary development, backed by more than two years of successful performance on major trunk lines, is a genuine contribution to present-day demands for lower maintenance costs.

Many WOOLERY Tie Cutters have paid for themselves in 60 days. Through careful design the machine is extremely portable and easily moved to the job on a motor car. It can be removed from the track in ten seconds by one operator.

For BETTER, ***faster*** and less expensive tie replacement, let us arrange a demonstration on YOUR road . . . we want you to get the facts ***first-hand.***

Write for the new 12-page booklet describing this real money saver.

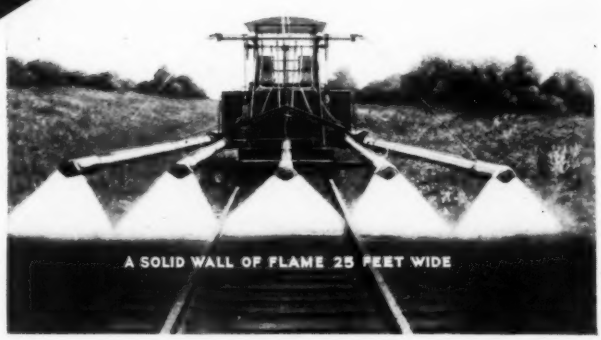
WOOLERY WEED BURNERS

OUTSTANDING ECONOMY,

Safety and Flexibility are assured in each model of WOOLERY Weed Burners.

The two-burner MIDGET OCTOPUS is ideal for short line railroads, and for work around yards and terminals. The three-burner and five-burner GIANT OCTOPUS models, with additional spread of weed destroying fire, are indispensable to maximum efficiency in main line roadbed work.

Write for complete information on WOOLERY Weed Burners . . . they are contributing to ***greater economy*** on railroads throughout the world.



A SOLID WALL OF FLAME 25 FEET WIDE

WOOLERY MACHINE COMPANY

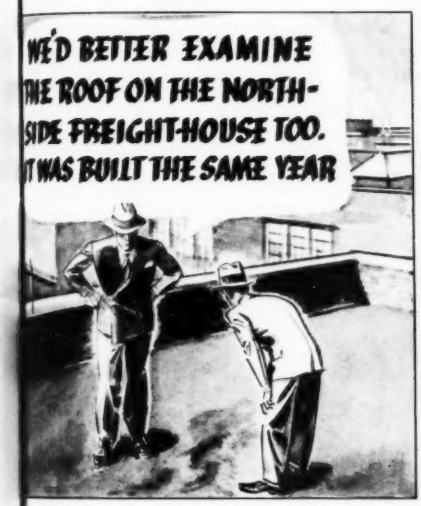
MINNEAPOLIS MINNESOTA

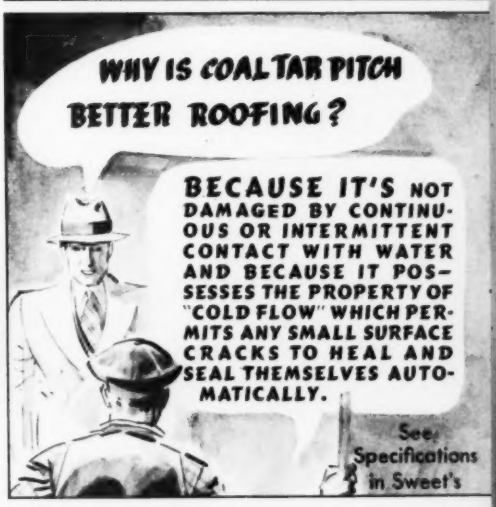
Pioneer Manufacturers of
RAILWAY WEED BURNERS · MOTOR CARS
BOLT TIGHTENERS · TIE SCORERS · HEAVY
DUTY WORK CARS · TIE CUTTERS . . . .

WOOLERY MINNEAPOLIS

RAILWAY MAINTENANCE EQUIPMENT

KEEP OUT WATER WITH KOPPERS COAL TAR ROOFING ★




WHY IS COAL TAR PITCH BETTER ROOFING?
BECAUSE IT'S NOT DAMAGED BY CONTINUOUS OR INTERMITTENT CONTACT WITH WATER AND BECAUSE IT POSSESSES THE PROPERTY OF "COLD FLOW" WHICH PERMITS ANY SMALL SURFACE CRACKS TO HEAL AND SEAL THEMSELVES AUTOMATICALLY.
See Specifications in Sweet's

OTHER KOPPERS PRODUCTS: Koppers Waterproofing . . . Dampness Resisting Paints . . . Bituminous-base Paints . . . Creosote Oil . . . Tarmac Road Tars for paving drives, parking areas, walks, station platforms, etc. . . . Disinfectants . . . Insecticides . . . Deodorants . . . Weed Killers, etc.

Pressure-treated Timber Products . . . Coal . . . Coke . . . American Hammered Piston Rings . . . Locomotive Packing.

KOPPERS COMPANY · PITTSBURGH, PA.

K O P P E R S product

When Disaster Struck

Power Jack helping restore one of the washed out main line tracks. On some washouts, as many as four Power Jacks were used on a single job.

POWER JACK *helps to restore washed out track*

A four-day torrential downpour was followed by the worst hurricane in New England's history. Track and bridges washed out—roadbed gone—hundreds of tons of fill and ballast to be put in quickly—these were some of the problems the railroads faced in restoring traffic after last September's disaster.

Every available Nordberg Power Jack was pressed into service at points of severe roadbed damage. Although originally purchased for normal ballasting and surfacing work, they demonstrated that they were equal to the emergency tasks to which they were put. By lifting track rapidly and releasing men for other jobs, they aided materially in getting track back into service sooner and reduced the expense of this emergency work. Whether in times of disaster or for normal maintenance work, the Nordberg Power Jack will give a good account of itself on any ballasting, grade raising or surfacing job.

THE NORDBERG LINE

Power Jack	Rail Grinder
Adzing Machine	Precision Grinder
Power Wrench	Utility Grinder
Spike Puller	Rail Drill

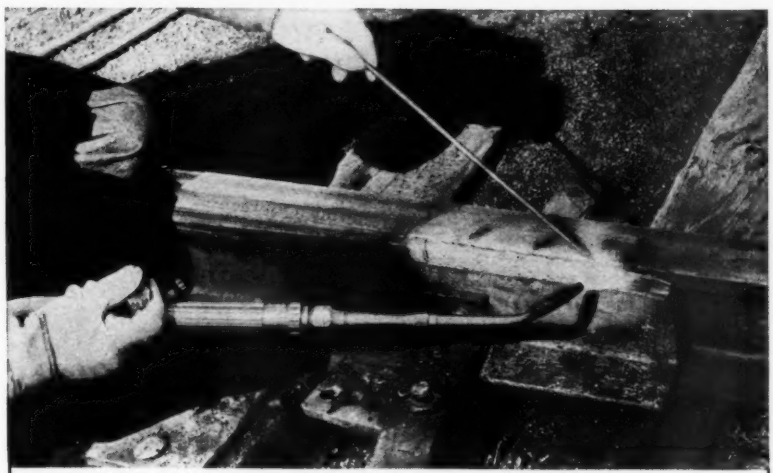
Track Shifter

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

Export Representative—WONHAM Inc.—44 Whitehall St., New York

Oxweld Railroad Service TOPICS

1912 — OVER A QUARTER CENTURY OF SERVICE TO AMERICAN RAILROADS — 1939



REPAIR FROGS AND SWITCH POINTS
at a fraction of replacement cost

Rebuilding worn switch points and the points and wing rails of frogs restores these parts to serviceable condition for as little as one-tenth of the cost of new units. These repair operations should be done in track if traffic is not too heavy. Otherwise, the switch points and frogs can be removed and reconditioned on the right of way or at the reclamation shop. Oxweld has developed a special welding rod for this work which provides a wearing surface that resists the impact and abrasion of heavy traffic and increases the service life of frogs and switch points.

FABRICATED SPECIAL TRACKWORK
A Recent Development

Maintenance-of-way departments of some railroads have been fabricating frogs and crossings from short rails and steel plate. Substantial savings can be effected in the fabrication of non-stock units with this new Oxweld development. Oxweld representatives will assist customer railroads in preliminary planning of the work and completion of the fabrication. In addition to the usual cutting and welding applications, the oxy-acetylene blowpipe is used for localized heating in the bending operations required in this work. A future advertisement will give more detailed information on fabricated special trackwork.

• • •

SURFACING SWITCH SLIDE PLATES

A repair operation which can be economically performed at the same time as the rebuilding of switch points is the surfacing of switch slide plates. Oxweld supplies a specially-developed, wear-resistant welding rod which is well-suited for the resurfacing work.

• BRIEFS •

Butt-Welded Rail — Maintenance of joints and signal bonds is eliminated and smooth-riding track is obtained when rail is butt-welded with the Oxweld Automatic Pressure-Type Rail Welding Process.

• • •

Hard-Facing — Haynes Stellite hard-facing rod is being increasingly adopted for protecting the wearing parts of equipment used in railroad yards. Recent applications include numerous car-retarder parts, tamper bars, shovel edges, and the wearing surfaces of other maintenance-of-way equipment.

• • •

Switch Point Protectors — To prevent damage to new or rebuilt switch points by wheels of cars and locomotives, switch point protectors may be provided by building a boss on the gauge side of

the rail a short distance in front of the switch point. A completed protector made in this manner is shown in the illustration.

• • •

In addition to bringing oxy-acetylene welding and cutting to railroads, Oxweld Railroad Service provides heat-treating of rail ends, hard-facing of wearing parts, pressure welding of rail, and "Unionmelt" welding. If there is a place for any of these processes in your operations, consult The Oxweld Railroad Service Company, Unit of Union Carbide and Carbon Corporation, Carbide and Carbon Building, Chicago and New York.

OXWELD RAILROAD SERVICE

The words "Haynes Stellite," "Oxweld," and "Unionmelt" are registered trade-marks of Units of Union Carbide and Carbon Corporation.

No. 126 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Two Letters

June 1, 1939

Dear Reader:

Among the numerous letters that we have received during the last month relative to articles published in recent issues of Railway Engineering and Maintenance are two that illustrate the scope and nature of our readership.

One of these came from the chief engineer of a large railway in the Argentine Republic and read in part as follows:

"I shall be greatly obliged if you can put me in touch with the manufacturer of the ditch grader illustrated on page 21 of the January, 1939, issue of Railway Engineering and Maintenance. A problem on this railway, which runs through a considerable mileage of completely flat country, is the periodic cleaning of the shallow side ditches, and any information which you can furnish regarding suitable and economical light equipment and methods of handling this phase of maintenance of way work will be greatly appreciated."

The other letter came from the chief engineer of a large railway in India and read as follows:

"I was interested to read in your issue for January, 1939, of an article known as ....., which has been used as a cushion under tie plates. I shall be greatly obliged if you will put me in touch with the makers of this material."

These letters, supplementing others from railways closer home, demonstrate the service that is being rendered railway maintenance officers throughout the world month after month by Railway Engineering and Maintenance. They illustrate also the manner in which this publication is creating markets for railway manufacturers in far distant parts of the world as well as at home, a service that is all too frequently lost sight of by these manufacturers when they scan their advertising programs in an effort to reduce expenses.

Yours sincerely,

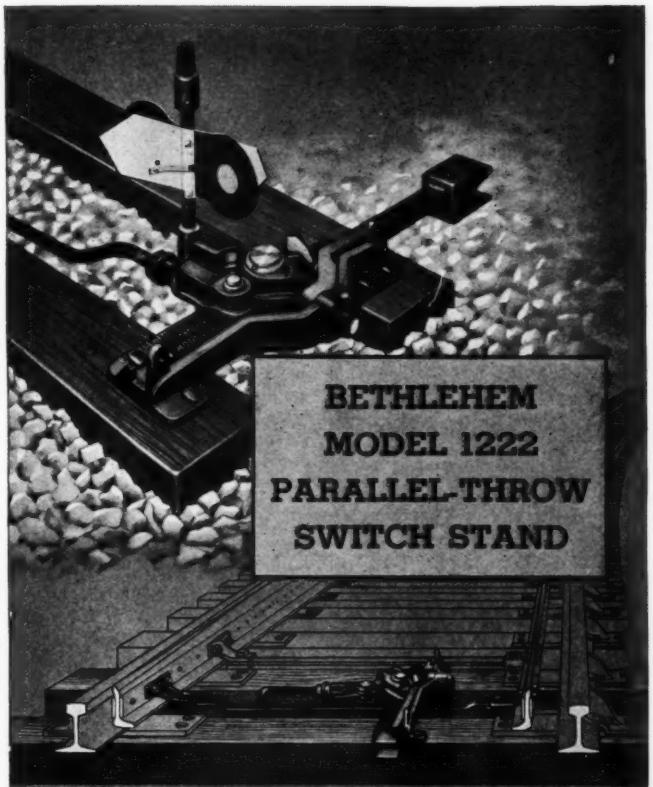
Elmer T. Howson

Editor

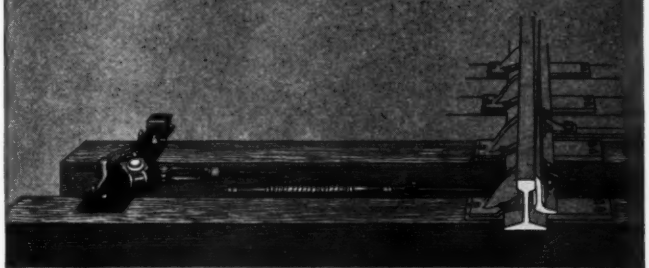
ETH:EW

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

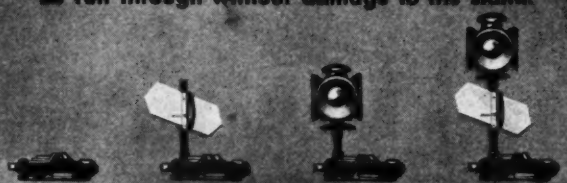
A low-cost, rugged switch stand



Since stand is only 4¼-in. high, in confined locations it can be installed between the switch points.



Through the use of a spring rod, points can be run through without damage to the stand.



A special crank makes possible any of these combinations of target and lamp.

PARTICULARLY RECOMMENDED FOR YARDS

HERE is a switch stand with every qualification for yard work: low in height; heavy-duty; parallel-throw for safety; and above all, low in cost.

Action is based on the block-and-slot principle. Only three parts move: a weighted lever; block pivoted on this lever; crank, with a slot in which the block slides. Action is positive and self-locking. With the lever in either normal position, the mechanism is on dead center and cannot be thrown by any thrust against the switch points. Locking holes are provided, however, so that the stand can be padlocked.

With its weighted lever, the stand is relatively easy to throw, and can handle any weight of rail. Length of throw can be quickly adjusted by means of the screw-eye type of crank. A spring rod can be furnished so that the switch can be run through without damage.

Model 1222 is ideal for confined locations. From the top of the tie to the base of the lamp or target mast it is just 4¼ inches high. For this reason it is sometimes located between the switch points, and a cast-iron box and lid can be furnished if desired.

Through the use of a special crank, the stand will accommodate a target lamp, target, or both. These plug into the crank itself and in no way interfere with the throwing mechanism.

Model 1222 Switch Stand is standard with many roads. With its safety features, its low maintenance, and its positive action, it should be seriously considered for all off-the-line switches.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

Two carloads of *Protection!*

124 CULVERTS OF U·S·S GALVANIZED COPPER STEEL ON THEIR WAY TO WORK! Ready to provide freedom from maintenance troubles. And each of these culverts may prevent the expending of many times its cost for roadbed upkeep.

against Washouts, Slides, Sunken Roadbeds

MANY of your biggest maintenance problems can be traced directly to faulty drainage. Slides, water pockets, wet spots, factors that make any roadbed expensive to keep in condition can be controlled if metal culverts are installed where needed. The adequate use of culverts of U·S·S Galvanized Copper Steel can greatly reduce the possibility that water in the wrong place will tie up schedules, men and equipment.

Culverts of U·S·S Galvanized Copper Steel are light in weight. They handle easily and, consequently, reduce installation costs. They are strong and durable, constructed to withstand the shock and stress of heavy loads, the pressure from sudden freezes, thaws and sub-soil shifting. Vital, too, is the extra life that may be obtained with culverts of this material. Metallurgists long ago discovered—and proved that the addition of copper to the molten steel provides the protection needed to resist corrosion from alternate wet and dry conditions.

We will be glad to suggest ways that U·S·S Galvanized Copper Steel Culverts can help in the solution of your drainage problems. Feel free to write to any of the companies listed below for complete information. You can quickly obtain culverts of U·S·S Galvanized Copper Steel from the culvert manufacturer near you.

USS COPPER STEEL CULVERT SHEETS

Look for this symbol on steel products. It represents the highest quality, the finest metallurgical service.

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*

Scully Steel Products Company, Chicago, *Warehouse Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

JUNE, 1939

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DO YOUR 1939 PLANS INCLUDE...

1. LINING BAGGAGE CARS? 2. STATION MODERNIZATION? 3. GRADE-CROSSING ELIMINATION?

The Milwaukee Road baggage car.

CB&Q waiting room, Manhattan, Kansas.

Erie Railroad underpass at Peth, N. Y.

You can do all these jobs—and dozens more—
FASTER, BETTER, CHEAPER
with versatile DOUGLAS FIR PLYWOOD!

● Douglas Fir Plywood is the one lumber that fits perfectly into any building or modernizing program you have. These engineered panels have advantages of large size, strength and lightness no other material gives you *at such low cost!*

Thousands of freight and baggage cars, travelling over all parts of the United States, are proving daily that Douglas Fir Plywood linings really protect ladings and baggage from dirt and damage. Scores of stations have been given fresh, new, puncture-proof interiors of Douglas Fir Plywood. Concrete viaducts and bridges of all sorts have smoother surfaces and were built at lower cost with Douglas Fir Plywood forms.

But these are just a few of the dozens of ways railroads are using this engineered lumber. Investigate it. Let it solve many of your problems. You'll find it easy to select and specify the right grade of Douglas Fir Plywood for every job. Today every panel is "grade trade-marked". Learn to recognize the trade-marks below—order by them.

PLYPANEL Use this grade for freight and baggage car linings, fine paneling, cabinets, furniture . . . everywhere perfect surfaces are desired.

PLYWALL This is the wallboard grade. Ideal for walls and ceilings; for covering cracked, dirty plaster; for bulletin boards and unlimited interior uses.

PLYFORM Unexcelled concrete form material. Serves as sheathing and lining combined. Gives smooth, flawless surfaces. Can be reused as many as 15 times, then salvaged for sheathing, etc.

PLYSCORD Use this grade for sheathing buildings, sub-flooring, shipping containers and boxes..and wherever strength and rigidity but not absolutely perfect surfaces are required.

EXT-DFPA This grade of Douglas Fir Plywood is made with water-proof glues and is ideal for permanent outdoor uses such as siding for buildings, decking, signs, refrigerator car linings, etc.

INSIST ON THESE "GRADE TRADE-MARKS" WHEN YOU ORDER!

A well-equipped Technical Division offers you cooperation in adapting Douglas Fir Plywood to railroad uses and recommending the proper types and grades for your needs.

DOUGLAS FIR PLYWOOD ASSOCIATION, Tacoma Bldg., Tacoma, Wash.
Please send me your free Grade Use Guide.

Name_____ Address_____

City_____ State_____

Railway Engineering and Maintenance

Safety

An Achievement Worthy of Recognition

THERE is no achievement of the railways in which every employee is warranted in taking more justifiable pride than that established in safety to both patrons and employees. They are entitled to pride because this record is made possible through their co-operation. They may emphasize it also because of the marked contrast which this record of the railways bears to those established by their competitors on the highways and in the air. And this record was raised to new high levels in almost every important aspect last year.

The Record of 1938

In train accidents, the number, compared with the miles run by trains, was the lowest on record. It was one-third less in 1938 than in 1937 and two-thirds less than in 1929. Likewise, with respect to casualties to employees, the record was the best in 50 years.

Fatalities to employees on duty resulting from all kinds of accidents totaled 479 in 1938, a reduction of 28.1 per cent from the 666 in 1937, and of 64.5 per cent from the 1,348 in 1929. Compared with the number of man-hours worked, there was a reduction of 13.5 per cent in the frequency of fatalities to employees in 1938 as compared with 1937, and of 31.6 per cent as compared with 1929. Non-fatal injuries to employees declined 31.6 per cent in number in 1938, and 17.6 per cent in frequency on the basis of man-hours worked, compared with 1937, and declined 73.1 per cent and 50.8 per cent, respectively, compared with 1929.

Passenger fatalities resulting from train accidents totaled 52 in 1938 compared with 3 in 1937. Of this total, 40 fatalities resulted from one accident for which a cloudburst was responsible; 8 passengers were killed in a collision resulting from a man-failure; and 3 passengers were fatally injured as the result of a derailment caused by a passenger train colliding with a truck at a railroad-highway grade crossing. The other fatality resulted from the collision of two passenger trains.

Grade Crossing Accidents Decline

Fewer passengers lost their lives in accidents at railroad-highway grade crossings in 1938 than in any year since 1915, with the exception of one year, 1933. These fatalities totaled 1,517 in 1938, a decrease of 358 as compared with 1937. At the same time, there was a reduction of 1,118 in the number of persons injured, bringing about a reduction of 21.1 per cent in the number of casualties resulting from grade crossing accidents in 1938, as compared with the preceding year.

The progress that is being made in the control of accidents at grade crossings is illustrated by the fact that the fatalities at such crossings in 1938 were 16.1 per cent less and the injuries 25.3 per cent less than in 1922, while during the same period the number of registered automobiles and trucks increased 136 per cent, although locomotive miles decreased 26.3 per cent.

Casualties to trespassers on railroad property declined from 2,569 fatalities and 2,629 non-fatal injuries in 1937 to 2,298 fatalities and 2,429 non-fatal injuries in 1938, a decrease of 9.1 per cent.

Including casualties to all types of persons—passengers, employees, persons at grade crossings and trespassers—the number of fatalities in 1938 was reduced 15.9 per cent and the number of non-fatal injuries was decreased 25.7 per cent, as compared with 1937. As compared with 1929, the number of fatalities was reduced 30.7 per cent and the number of non-fatal injuries 64.6 per cent.

Such a record reflects great credit on railway employees and managements alike. That it should occur in a year of such stress and pressure for reduction in expenditures of all kinds indicates the determination of the railways and their employees to promote safety of patrons and employees at all costs and to do nothing, even in times of such extreme stress, that will create hazard. It reflects a recognition of public responsibility that is heartening and that should be broadcast by every employee.

The Contrast with Other Agencies

This record is especially illuminating when considered in comparison with records made by other transportation agencies. Although handling relatively few passengers as compared with the railways, airline crashes make the headlines of newspapers with disturbing frequency, with the result that not a few commercial companies are coming to restrict their officers from the use of planes because of the hazard.

On the highways, conditions are tragic. With more than 32,000 persons killed and over half a million injured in highway accidents last year, the slaughter has become a national disgrace. And the number killed and injured in accidents in which vehicles engaged in common carrier

transportation operations are involved is out of all proportion to the number of vehicles so engaged, with the result that a popular clamor is arising for the more drastic regulation of these buses and trucks. Furthermore, not a few of the accidents included in the railway totals arise at crossings where trucks, and occasionally buses, are driven directly in front of, or into the sides of, trains.

In brief, in 1938 a passenger was 14 times safer on a train than on a bus, 32 times safer on a train than on a regularly scheduled flight of a transport airplane, and 544 times safer than on all types of airplanes. Such a record is an outstanding achievement from every angle. It reflects credit alike on employees and managements. It does not just happen but is the result of well-planned, carefully executed operations, directed by managements and performed by employees who are safety-minded in every detail of their operations.

The record of last year affords a splendid indication of the fundamental stability of the railway industry to which every employee can afford to point at every opportunity, to the end that the public at large will be brought to an adequate realization of the safety of railway service and induced thereby to travel and ship by rail as a precaution for the protection of its lives and properties.

Gage or Line—

Which Should Be First in Repairing Track?

AT THIS season when maintenance programs are getting well under way, during which much track will be surfaced, lined and gaged, the long-debated question again arises as to whether track should be gaged before or after it is lined. Both sides of this question have their proponents, and experienced trackmen are not in agreement. No one denies the interdependence of gage and line, for experience has demonstrated that if the gage is wide or irregular neither line nor surface can be maintained successfully, and that poor line often results in poor gage. For this reason, statements as to precedence in the sequence of correcting these irregularities must generally be qualified and sometimes be accepted with certain reservations.

In substantially all general maintenance, the lining of the track is the last operation performed, except the dressing of the ballast, in which case the gaging obviously precedes the lining. If gage and line are only slightly imperfect it is generally considered preferable in this type of work to gage before lining. If, on the other hand, both gage and line are grossly irregular, many foremen consider it an advantage to line the track, complete the gaging and then go over the line of the track a second time.

Where the track is being given a general overhauling, all new ties must be spiked to gage, slued ties straightened, tie plates adjusted and all ties spiked securely in advance of surfacing. If the track is badly out of line at the time it is being gaged, it will be difficult to line and equally difficult to hold in line afterwards. For this reason, many foremen contend that, although it involves some time and expense to do so, the track should be lined in advance of the tie renewals and gaging and again after the surfacing is completed. Those foremen who have followed this practice contend that it eliminates the short line kinks that almost invariably result where the line is grossly irregular at the time the gaging is done, and that the advantages in reduced later maintenance will more than offset the expense of the preliminary lining of the track.

It is almost axiomatic that if the gage is irregular, the rails are loose in the spikes. For this reason, where the track is to be lined without reference to other work and is out of gage, it should be gaged and all spikes driven to a snug fit in advance of the lining; otherwise it will be impossible to hold the rails in position permanently after they are lined, and it may be necessary to repeat the lining after the gaging is completed.

Another factor has been introduced by the widespread adoption of double-shoulder tie plates. Both these larger and heavier tie plates and the heavier and stiffer rail with which they are used resist the lateral forces acting on the track and therefore tend to hold it in line and gage far better than the lighter tie plates and smaller rail which they are displacing. Yet this resistance makes it more difficult to line the track and, if it is gaged before it is lined, it may be extremely difficult to straighten out the short kinks that have been mentioned, or to prevent them from returning. With this design of tie plate the correct fit of the shoulders against the base of the rail is important. For this reason, if the track is lined before it is gaged, the tie plates can then be straightened to give the shoulders the correct fit, and the track is much more likely to stay in good line.

Treated Timber—

Use in Buildings Gaining Acceptance

IT is a strange inconsistency that the railways, pioneers in the use of treated timber in this country and throughout the years the largest users of this material for crossties, piling, bridges, poles and many other outside purposes, have been so slow to adapt this same material to those parts of railway buildings where there is every indication that to do so would result in the same ultimate economy. It is true that all of the roads did not turn to treated ties and bridge timbers at the same time for one reason or another, and that even today they are not all of the same mind with regard to the extent and best type of treatment for these various purposes, but even this does not explain the almost universal disregard, until the last few years, of treated material for building purposes.

It is recognized that many parts of buildings are not subject to the same degree of decay and attack by insects as crossties and parts of bridge structures, but, at the same time, it is becoming much more widely appreciated that there are many parts of buildings of frame construction, especially those in particularly moist locations or supported on timber foundations, that are subject to premature decay or attack by termites, with consequent increased maintenance costs. Some roads, cognizant of the benefits to be derived and stimulated by increasing material and labor costs, are specifying the use of treated timber in buildings wherever it comes in contact with the ground. Others, for buildings subject

to particularly moist conditions, or in territories which have shown the prevalence of termites, have extended this to include first floor sills and joists, basement window frames and sash, and foundation enclosure lumber, the purpose being to use the treated material to a point well above normal ground moisture, or to a level at least above that which can be reached readily by the galleries of subterranean termites. Still others have used treated timber for wall posts and studs and for roof timbers and sheathing in shops and enginehouses subject to high humidity conditions, and a few have experimented with it for building siding as well in territories subject to particularly moist atmospheric conditions. For these purposes they are employing both creosoted and salt-treated timber as seems best suited to their conditions, the former being given preference where there is direct contact with the ground, and the latter for purposes above ground where the appearance or odor of creosoted material, or contact with it, might be objectionable.

An outstanding example of the use of treated material, both creosoted and salt-treated, in building construction is described in this issue, this having to do with the repair of one of the large merchandise piers of the Chesapeake & Ohio at Newport News, Va. This work involved the laying of more than 400,000 ft. b.m. of salt-treated black gum decking, the application of approximately 40,000 ft. b.m. of salt-treated pine siding, and the almost complete renewal of all window sash, frames and doors with salt-treated pine. In addition, the work involved the renewal of much of the substructure, including piles, caps and sway bracing, with creosoted pine. This example of the adaptation of treated material to a railway building is unusual in the size of the structure involved and in the extent to which treated material was used, but it is another indication of a definite trend toward the increased use of treated lumber in buildings, a trend which has been exceedingly slow in developing, but which promises to gain impetus as the need continues to grow for securing the maximum return from every dollar spent for building construction and maintenance.

Stream Erosion—

Several Roads Have Found Solution

SINCE the early beginning of the railways in this country, one of the important problems confronting many engineering and maintenance officers has been the control of erosion in steep lateral streams, where, in times of floods, hundreds of tons of loose rock, sand and gravel are washed down by the water to choke the stream beds, block openings, and, not infrequently, inundate the tracks or cause washouts by forcing the flood waters into new, inadequate channels. Problems of this character have presented themselves in many parts of the country, from New England to California. Frequently, the most harmless appearing creeks have defied the efforts of those who attempted to prevent or overcome their forceful eroding ability in times of floods. In fact, in many instances there has appeared to be no solution of the problem except to dig out after each flood to make room for the next deluge of rock and debris. In many cases, raising of the tracks and the enlargement of waterway openings are not important considerations, as the streambeds become choked upstream from the right-of-way, causing the flood waters to seek new channels and new outlets beneath the tracks. In some cases, even the continued removal of material brought down periodically becomes extremely difficult, as in so doing high banks are built up on both sides of the channel, leaving no room for more, and requiring costly hauling for considerable distances.

Such considerations prevailed at a number of lateral streams along the Erie in the upper part of New York State a few years ago, and extensive investigation made it evident that the ultimate solution of the problem, relatively expensive in first cost but economical in the long run, was to establish a noneroding flow in the streams through flattening their gradients and widening their channels. This was accomplished through excavation and the construction of a system of dams across the creek beds at proper intervals, forming silting pools behind them. As contemplated, these retarding dams and pools were highly effective in stopping the movement of eroded material from the upper reaches, and even when they became full of such material, the new gradient formed was such as to produce a rate of flow with minimum eroding ability.

Other roads have found this system of flood control equally effective, and a most interesting example is cited in an article in this issue which describes the effective erosion control work established in a creek at Maiden Rock, Wis., by the Chicago, Burlington & Quincy. Here, where repeated damage had been done through the years to the railroad, the town and private property by the heavy movement of rock in the creek bed with every sizable storm, the situation was remedied by the construction of a series of dams up the creek to retard the rate of flow in these areas, supplemented by paved flumes in the lower reaches of more restricted channel width, to produce an increased rate of flow which will not permit the deposit of any silt which may be carried over from above.

The methods employed here obviously have their limitations of practicability, at least when considered solely as railroad projects, but they suggest a most effective means for the solution of similar problems at other points. However, regardless of how similar problems of this character may appear to be, experience has shown that the most effective and permanent solution of each must be based upon a carefully obtained case history of the stream involved, including peak volume and velocity data, and a thorough understanding of the principles underlying the method to be employed. Working with anything less than complete data of such character may result in failure of even the ideal method of solution, with hazardous consequences, disappointments and the useless dissipation of funds.

Southern Butt-Welds Rails in Track

Right—Chamfering a Rail End in Preparation for Gas Welding. Above—Abutting Rail Ends, Ready to be Welded

This road has installed a mile of test track in which the existing rails were butt-welded into continuous lengths, using gas welding for one-half the joints and arcwelding for the other half. This article gives the essential details of the installation and describes the two welding procedures that were employed

IN an experiment to determine the relative performance of different types of butt welds under comparable conditions, the Southern has butt welded the existing rails in a mile of track, using the oxy-acetylene and the arc-welding processes for substantially equal numbers of joints. This work is of special interest because the welds were made in the track with rail that had been in service for 14 years and also because the installation was made with standard track fastenings, the only precautions taken against movement of the rails being the use of double-shoulder tie plates and an increase in the number of anti-creepers.

Location of Test Welds

This installation was made in a mile of tangent track in the southbound freight main near Alexandria, Va., eight miles southwest of Washington, D. C. The track is laid with 33-ft. 100-lb. R. E. section rails, with four-hole angle bars and single-shoulder tie plates. The track is on a grade of 0.25 per cent ascending in the direction of traffic and before the joints were butt welded it was anchored against movement in this direction with 12 anti-creepers in each panel.

In making the butt welds the joints in the south half of the mile, involving 162 welds, were made by the oxy-acetylene process, and those in the north half, involving 160 welds, were made by the arc-welding process. As a part of the project the existing tie plates were converted into double-shoulder plates by fillet-welding hot-rolled steel bars, ½-in. square and of appropriate length, to the plates on the inside of the rail, this operation being carried out by the arc-welding process along with the butt-welding work. For anchoring each of the continuous rails against movement in the direction of traffic, an anti-creeper was placed at each tie, while to prevent movement in the opposite direction anchors were placed at alternate ties. Thus the rails are held against movement in the direction of traffic by 40 anchors in each panel of track and against movement in the opposite direction by 20 anchors in each panel.

To avoid conducting the butt-welding work involved in this project during extremes of temperature, it was carried out during the fall of 1938. In preparation, the track was lined and surfaced out-of-face, new crushed stone ballast was added and defective ties were renewed. While the welding work was in progress the track was taken out of service during working hours, and in each case the operations were started at one end of the half mile and carried forward out-of-face.

The Gas Welding

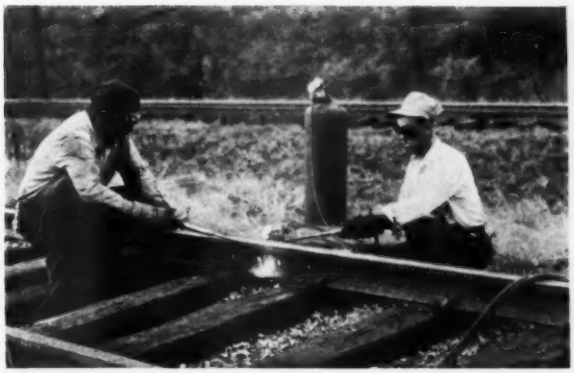
The technique employed in making the gas welds involved no marked deviation from previous practice. The angle bars were first removed and alternate rails offset about 6 in. so that the ends would be accessible for chamfering, which was done with a cutting torch. In this operation the head of the rail was cut back on a 30-deg. angle in such a manner that the beveled surface is in a plane which cuts the running surface on a transverse line about 1½ in. back from the rail end and intersects the web at a point ¼ in. below the underside of the head. Thus the head welds were of the V type.

The web of each rail end was beveled from both sides on 45-deg. angles in such a manner that the two beveled surfaces intersect along the vertical center line of the web. Thus, when the two rail ends were placed in position for welding the beveled ends of

In the First Step, the Weld Is Carried Up Both Sides of the Web

the webs formed two vertical V joints, one on each side of the rail. In beveling the base flanges, the entire thickness of each flange was cut back on a 45-deg. angle so that adjoining flanges formed a single-V joint that permitted the base weld to be made entirely from above. After the beveling operation was completed any slag remaining on the rail ends was knocked off with a hammer and chisel and all oxide was removed with a hand-held vertical wheel grinder.

In lining up the rails in preparation for welding, they were so spaced as to leave a ¼-in. gap between adjacent ends. Also the two rail ends were cocked up about ⅛ in. to counteract the effect of unequal expansion of the rails which takes place during the welding operation.



Below—Starting the Weld in the Head Section, Using a Back-Up Plate. Right—Reheating the Weld in the Normalizing Process

Welding Procedure

Using a No. 8 Airco welding tip, each butt weld was made by one operator in accordance with a definite sequence of operations. The weld was started at the junction of the web and base on one side of the rail and was carried upward to the junction of the web and the underside of the head. This operation was then repeated on the other side of the rail, after which the base welds were made, being started in each case at the junction of the web and the base and carried outward. When these parts of the weld were completed, any metal that had penetrated through to the underside of the base, as well as excess metal on the other parts of the weld, was "washed" off with a welding torch producing a smooth surface.

The last portion of the weld to be made was that connecting the heads of the rails. When starting this weld a back-up plate was held against the underside of the head by the helper to provide a floor for the puddle. The making of this portion of the weld also involved the building up of the rail end to compensate for any batter, the extent of the batter having previously been indicated on the rail with keel marks. When the application of metal in the head weld had been completed, the surface was hammered with a 2½-lb. ball peen hammer.

After Completing the Web Weld, the Base Welds Are Made, As Shown

Chrome-Vanadium Rod

For making these welds a chrome-vanadium welding rod, known as the Airco DB R R rod, was utilized. For the base, the web and the lower half of the head a 3/16-in. rod was used, but for making the weld in the upper half of the ball the size of the rod was increased to ¼ in.

As soon as a butt weld was completed, it was heated in a normalizing operation to a temperature of 1100 to 1200 deg. F. for a distance of about one inch each way from the center of the weld. This operation was performed by two operators with torches who worked on opposite sides of the rail, beginning simultaneously at the base and working upward toward the head.

To control the cooling rate after post-heating, the joint was packed in asbestos, held in a trough-shaped pan of galvanized iron, which was left in place until the temperature dropped below 300 deg. F., requiring about two hours in this instance. The joints were finished by grinding in the usual manner, using a cup-wheel grinder for finishing the running surface and a vertical- wheel unit for removing the excess weld material from the sides of the heads of the rails.

Gang Organization

Owing to the fact that this project was utilized as a training school for gas welders from various parts of the system, the gang organization showed considerable variation from time to time during the course of the work. For much of the time, however, there were four welders at work on the project, and with this number of welders the gang organization included one man for beveling the rail ends, one grinder operator and four helpers, who performed all auxiliary operations, such as removing the angle bars, off-setting the rails and lining them up later, changing connections on the gas cylinders and packing the joints in asbestos.

With this organization, the practice during the course of a day's work was to bevel the rail ends at four more joints than could be welded during that day and to replace the angle bars at these joints. This practice made it possible, when commencing operations on the following morning, for the welders to start work as soon as the angle bars on the beveled joints had been removed and the rail ends lined up properly.

Experience on this project showed that after the welders had become familiar with the procedure employed, they could complete a joint in about 1 hr. 45 min. of actual welding time. The average output of each welder per day was three joints. For the 162 joints that were gas welded on this job, the average consumption of gases per joint, including that used during both the welding and the post-heating operations, amounted to 122 cu. ft. of

oxygen and 127 cu. ft. of acetylene. An average of 2 2/3 lb. of welding rod went into each butt weld.

The Arc Welding

For arc-welding the rail in the other half-mile of test track, a special method of making electric butt welds was employed. This method involved five principal steps, namely: (1) Preheating in preparation for chamfering and welding; (2) chamfering, using the electric arc; (3) making the weld; (4) post-heating and normalizing; and (5) grinding.

After the angle bars had been removed from individual joints in preparation for making the butt welds, all rust, scale and other foreign matter was cleaned off the rail ends with a wire brush and a portable electric grinder. For pre-heating the rail ends, an asbestos-lined steel hood 24 in. long was used, into an opening in the side of which the flame from a kerosene torch was introduced. With this apparatus, the rail ends were heated to a temperature of 800 deg. F., this temperature being checked by means of a hand pyrometer.

Chamfering

In chamfering the rail ends, the head zones and base flanges were cut back from the ends in such a manner as to form open-root single-V butt joints in these parts. In the head zone the opening thus formed was about 1 in. wide at the junction of the head and the web, while at the base flanges the opening at the root of the weld (lower surface of base) was about ½ in. wide.

The treatment of the web areas of the rail ends in the chamfering process differed from that described above in that these portions were cut back in such a manner as to form a closed "U" joint on each side of the rail, leaving untouched a 3/16-in. thickness of the web along the vertical center line of the rail. In this operation, which was begun at the top of the web first on one side of the rail and then on the other, the cut formed across the rail ends on each side of the web was semi-circular in horizontal section, and approximately 1 in. wide at the surface of the web. The 3/16-in. thickness of metal that was left along the vertical center lines of the adjacent webs by the foregoing method of chamfering served as a back-up plate during the welding process. In the latter operation the welds on opposite sides of the web were each said to penetrate one-half the distance through this wall, thereby resulting in 100 per cent penetration for the weld.

The first step in the welding process involved the tacking of a mild steel back-up plate, 3/16 in. thick, 1½ in. wide and 5¾ in. long, to the undersides of the adjacent rail bases. Next, the base welds were made, first on one side and then on the other, and after the application of each bead or layer of metal had been completed, the flux coating was removed from the weld metal and the latter was hammered with a blunt-nose tool to relieve shrinkage stresses and to remove scale.

Top—The Hood That is Used for Both Preheating and Post-Heating in the Electric-Welding Operation. Top Center—Chamfered Rail Ends Ready for Welding. Lower Center—Partially Completed Electric Butt Weld. Bottom—Shows How the Electric Welds Are Packed in Asbestos in the Normalizing Operation. A Separate Hood is Used for Covering the Head Section

When the base weld had been completed, the welding of the web section was undertaken. This weld was started at the junction of the web and the base and for that reason was essentially a continuation of the base weld. After it had been carried about 2 in. up the side of the web it was hammered while hot, and the welder then proceeded to the other side of the rail where he repeated the operation. He then moved again to the opposite side and continued the weld up to the junction of the web and the head. When this weld had been hammered, the operation was repeated on the other side of the rail, thereby completing the weld in the web section.

In preparation for starting the head weld a copper back-up plate, formed to the proper contour, was clamped to the underside of the two rail heads on each side. The application of metal was then commenced and when a suitable foundation had been formed the back-up plate was knocked off by a light hammer blow and the welding operation continued. As when making the base weld, each layer of applied metal was thoroughly hammered before application of the next layer was undertaken. When the weld reached the running surface of the rail, sufficient additional metal was applied to the top of the weld and to the rail metal in each direction to compensate for any batter that might be present. After the application of metal had been completed on top of the head, the weld was again hammered.

Normalizing

As soon as the welding operation had been completed a hood identical to that used in the preheating operation was placed over the butt weld and the welded section was post-heated to a temperature of 1,450 deg. F., again using a hand pyrometer to check the temperature. When the temperature had been brought to the desired level, a normalizing hood was placed over the joint to control the rate of cooling. This hood is in two parts, one for the head, which is somewhat similar to the heating hood, and another for the web and base of the rail. The hood covering the head is lined with asbestos and is so designed that it can be removed quickly to allow trains to pass. When the temperature of the head weld had been reduced to 300 deg. F., the hood over this portion of

the rail was removed and the weld was allowed to cool in the atmosphere.

For slow-cooling the web and the base at the joint, a trough-shaped container rectangular in cross-section was used. This pan enclosed the rail on the sides and bottom and was fitted with hinged end pieces, four in number, that folded in against the web of the rail, thereby providing a container that was enclosed on all sides but the top. When applied to a weld, this container was filled with ground asbestos to a level even with the underside of the rail head, and was left in place until the weld had completely cooled. Because of its position it was not necessary to remove this pan to permit the passage of trains. By means of the foregoing method of normalizing the welds it is said that a pearlitic grain structure was obtained in the base and the web, while the head of the rail, since it was cooled somewhat more rapidly, is slightly harder.

In grinding the electric-welded butt joints excess metal was removed from the running surface and sides of the head with an electric hand-held vertical-wheel grinder powered from the welding generator. The finish grinding of the running surface was accomplished by means of a track-mounted surface grinder.

The organization employed in the electric welding work consisted of two welders, one grinder operator and one helper. Individual welds required from 1 to 1½ hr. to complete, and the two welders were able to make an average of about 10 welds daily. Welding current was supplied by a multi-operator Diesel-powered generator embodying two 200-amp. generators operating on a common shaft.

The gas-welding work was done by company forces under the supervision of representatives of the Air Reduction Sales Company, New York, while all of the electric butt welds and the shoulder strips on the tie plates were installed under contract by D. B. Hunt, Atlanta, Ga.

Rail Production Slumped To a Five-Year Low in 1938

THE poor business conditions which prevailed generally during the latter part of 1937 and throughout most of 1938, especially in the railway field, were reflected in the rail production in 1938, which, as shown by statistics compiled by the American Iron & Steel Institute, fell from a seven-year peak of 1,445,739 tons in 1937 to a five-year low of 622,895 tons in 1938 and ranked with the lowest production at the depth of the depression. By way of comparison, it is recalled that rail production from 1900 to 1929 ran almost constantly in excess of 2,000,000 tons annually, reaching a peak of 3,977,887 tons in 1906 and averaging well above 2,800,000 tons during the five years 1925 to 1929. The production in 1938 was smaller than in any years except 1932 and 1933, when production fell to 402,566 tons and 416,296 tons, respectively. It was 387,329 tons under the production in 1934; 88,642 tons under that of 1935; 596,951 tons under that of 1936; and 822,844 tons, or 56 per cent, under that of 1937.

As might be expected in view of the low total production in 1938, the tonnages rolled in each of the weight classifications fell far below those of 1937. In the group including sections weighing 120 lb. and less than 136 lb., production amounted to 167,887 tons, approximately 43 per cent of that in 1937, and in the group weighing 100 lb. and less than 120 lb., production was 331,727 tons, or approximately 45 per cent of the tonnage in that group in 1937. In the heaviest weights of 136 lb. and more, the group that has come into greater prominence in recent years, production was only 2,252 tons, or 7 per cent of the 31,238 tons of these weights produced in 1937.

In the lighter sections, including rails weighing 85 lb. and less than 100 lb., production was down 54 per cent from 1937, to 51,384 tons, while production in weights of 60 lb. up to 85 lb., dropped to 24,667 tons, as compared with 82,338 tons in 1937, almost exactly 70 per cent. In connection with this latter group, however, it should be noted that the 1937 production was unusually high as compared with other recent years, and that the 1938 production in this group, small as it was, was higher than in any other year since 1931, with the single exception of 1937.

As has been the case for many years, almost all of the rails produced in 1938 were of open-hearth steel, amounting to 602,981 tons, or nearly 97 per cent of the total production. The production of rails from Bessemer and electric steel amounted to only 55 tons, weighing 60 lb. or less. Rails rolled from old rails accounted for 14,974 tons of the year's total production, but this represented the smallest tonnage of such rails rolled in any year for which records are available, with the single exception of 1932. Other rails rolled in 1938 and incorporated in the total production of 622,895 tons included 17,415 tons of girder and high tee rails and 338 tons of alloy steel rails.

Production of Rails by Weight Per Yard

Years	Under 50 lb.	50 and less than 85 lb.	85 and less than 100 lb.	100 and less than 120 lb.	120 and less than 136 lb.	136 lb. and over	Total
1920	489,043	433,333	952,622		729,118		2,604,116
1921	211,568	214,936	902,748		849,566		2,178,818
1922	265,541	274,731	728,604		902,900		2,171,776
1923	272,794	300,907	864,965		1,465,850		2,904,516
1924	191,046	213,274	853,431		1,175,581		2,433,332
1925	163,607	219,648	765,371		1,636,631		2,785,257
1926	197,260	256,287	797,662		1,966,440		3,217,649
1927	161,836	173,257	539,445	1,314,424	617,524		2,806,486
1928	134,197	125,726	465,393	1,203,749	718,428		2,647,493
1929	141,362	102,944	409,628	1,233,599	834,605		2,722,138
1930	95,626	81,299	267,879	835,496	592,933		1,873,233
1931	50,089	25,524	123,398	495,752	462,988		1,157,751
1932	16,655	13,705	28,593	215,091	128,522		402,566
1933	*49,116	†15,413	40,973	154,007	156,787		416,296
1934	*70,085	†17,111	73,639	491,642	325,942	31,805	1,010,224
1935	*57,127	†14,758	85,627	340,800	154,367	58,858	711,537
1936	*96,111	†21,097	99,961	611,527	368,470	22,680	1,219,846
1937	*101,687	†82,338	112,638	727,929	389,909	31,238	1,445,739
1938	*44,978	†24,667	51,384	331,727	167,887	2,252	622,895

*60 lb. or less per yard. †Over 60 and less than 85 lb. per yard.

This Pier

Above—Pier 4 As It Appeared After the Renewal of the Siding and Doors with Salt-Treated Material Had Been Completed. Right—A General View of the Floor Renewal Operations on the Lower Level of Pier 4

Extensive repairs to a large frame merchandise pier on the Chesapeake & Ohio at Newport News, Va., were made almost exclusively with treated material, using a variety of woods and preservative treatments. In addition to the use of creosoted members in the substructure, the repair work included the application of salt-treated black gum in the deck, salt-treated pine for the siding and doors, and treated pine window sash and frames

IN making extensive repairs to a large frame merchandise pier, which involved the practically complete renewal of certain parts of the structure, such as the siding and decking, the Chesapeake & Ohio utilized treated timber almost exclusively, employing a variety of woods and preservative treatments. Particularly noteworthy is the fact that the material applied consisted of a large quantity of salt-treated timber, including black gum decking treated in part with Wolman salts and in part with chromated zinc chloride, and pine siding treated with chromated zinc chloride. Also the new window sash and frames are of pine treated with Permatol "A". In addition, a relatively small quantity of untreated oak and greenheart timber was inserted in the deck of the pier apron.

In accordance with the usual practice of this road, creosoted timber was used in all locations where the surfaces were not to be painted or where the creosote would not have an adverse effect on freight in storage. Elsewhere, particularly in the deck of the structure, the use of different species of wood and types of treatment was much in the nature of an experiment to determine their relative ability to resist wear and decay.

Pier Built in 1898

The structure involved in this work is a tide-water merchandise pier, known as Pier 4, at Newport News, Va. This pier, which was constructed in 1898, is an enclosed structure of the double-deck or two-story type. The lower deck is served by two depressed tracks extending the length of the pier while the upper deck carries a track at the floor level, which attains this level from the shore end by means of a timber trestle.

Exclusive of the apron or platform which surrounds it, the pier is 140 ft. wide and 620 ft. long. Along both sides, the apron is 10 ft. wide while at the out-shore end of the pier it is 30 ft. wide. The structure has a pile foundation consisting of 62 pile bents on 8-ft. 6-in. centers, on which the floor stringers for the lower deck are supported directly. For supporting the superstructure, 14-in. by 14-in. posts of untreated heart pine extend up to the second floor level, while 8-in. by 12-in. posts, extending above this level, carry the supporting structure for the roof which consists of a longitudinal high bay or monitor, 70 ft. wide, and a low bay on each side.

As originally built, the foundation bents consisted of creosoted cypress piling, 3-in. by 10-in. creosoted yellow pine sway bracing and caps of creosoted heart pine. The lower deck, including the apron, consisted of 4-in. by 8-in. untreated pine planks laid on 6-in. by 12-in. untreated pine joists, while the floor on the upper level was comprised of 3-in. by 8-in. planks on 6-in. by 16-in. joists. On both levels the floor timbers were laid at an angle of 45-deg. with the joists. All the original siding, studding and wall braces, as well as the window frames and the double-hung sash, were of untreated pine.

Condition of Pier

By 1937, when the extensive repair work on this pier was undertaken, nearly 40 years' service had taken its toll of the original material. While many of the original piling were still in a relatively sound and serviceable condition, others had been badly weakened by the action of teredo and

Repaired for Permanency With Treated Timber

decay and were in need of renewal. Teredo had also attacked the ends of the sway bracing that projected into the water, while many of the bolts in this bracing had been virtually destroyed by corrosion. The majority of the caps in the foundation bents were still in a serviceable condition.

Many Parts Affected

On the lower level, the floor and apron timbers were badly worn and were also exhibiting the effects of decay at the stringer contact points. Also about 25 per cent of the stringers on this level were in need of renewal because of decay along the top surfaces. On the upper level, the decking was still generally in a serviceable condition except for a strip along one side of the track where the floor had been subjected to hard usage due to the impact of hogsheads of tobacco and other heavy objects when dropped from the car floor level.

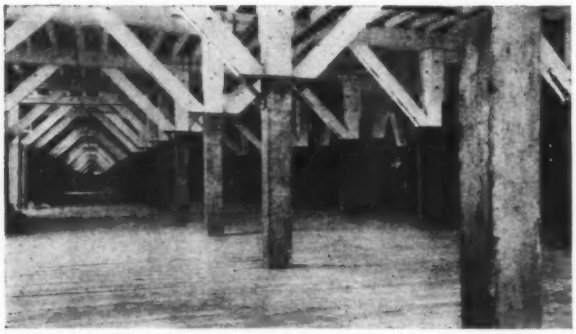
Owing to decay around the nails and the prevalence of checking and splitting, the siding and doors were in a generally bad condition, while much of the studding and wall bracing was badly decayed and had also been attacked by termites. Moreover, about 25 per cent of the outside posts had been similarly affected to such an extent that they required replacement, although the inside posts were still sound. Likewise, the window sash and frames were generally affected by decay and were in need of renewal.

Because of the conditions cited above, the repair program called for practically complete renewal of certain parts of the structure, such as the decking on the lower level and the siding, sash and doors throughout the structure. Elsewhere individual pieces were replaced as required, although, as applied to certain members, such as the studding and wall bracing and the sway bracing for the foundation bents, this meant almost complete renewal. Because of the generally sound condition of the decking on the second level, the only part of this material requiring immediate renewal was that contained in the narrow strip along the track which was about 16 ft. wide. The repair program also included renewal of about 25 per cent of the roof sheathing, using 1-in. untreated yellow pine.

Renewing the Decking

Four-inch by 10-in. black gum planks were used exclusively for renewing the decking on the lower level inside the pier, this wood being chosen because of its wear-resistant qualities. This required a total of about 310,000 ft. b.m. of black gum, part of which was treated with chromated zinc chloride and part with Wolman salts. This material was supplied in 9-ft., 12-ft., 15-ft., 16-ft., and 18-ft. lengths and was laid at right angles to the stringers with the heart side down and the joints staggered. Eight-inch wrought iron cut spikes were used for fastening the planks. To prevent the splitting of the timbers at the ends, where the bearing on the stringers was only 3 in., the spikes at these points

Below—Left—Looking Along the North Apron After the Deck Had Been Renewed with Treated Black Gum and a Small Amount of Untreated Oak. Center—On the Upper Level Where a Strip of the Deck Was Renewed With 3-in. Treated Black Gum. Right—The Deck on the South Apron of the Pier Was Renewed with Greenheart Timber and Treated Black Gum



A Portion of the Deck on the Lower Level of the Pier After It Had Been Renewed With Salt-Treated Black Gum Timbers

were driven through holes bored with a ⅜-in. bit.

The system employed for replacing the floor was to renew the decking in increments of three spans of the substructure so that the joists, which were three spans in length, could be replaced as the work progressed. After the old flooring over the three spans had been removed and the stringers renewed as necessary, about ten lines of the new flooring planks were laid loosely in the proper position. Then, by utilizing track jacks pressing against cleats nailed to the exposed stringers, the planks were held tightly together and in alinement while the planks in the outside line were nailed down. When the entire increment of flooring had been placed in this manner, spike holes were bored in the ends of the pieces and the spiking work was carried out in a continuous operation.

On the upper level the strip of flooring along the track was replaced with 3-in. by 8-in. black gum treated with chromated zinc chloride, about 67,200 ft. b.m. of material being required for this purpose. In this work, which was carried out a short time before the more extensive repair work was undertaken, the new flooring was laid diagonally so that it would line up with the existing decking.

Repairing the Aprons

The material used for renewing the apron deck of the pier included black gum treated with chromated zinc chloride, greenheart timber, creosoted pine and untreated oak. The latter material was applied somewhat prior to the extensive renewal program and is confined to a 365-ft. length of the apron on the south side of the pier and a 100-ft. length on the north side. A total of 30,000 ft. b.m. of black gum was used in the apron, this material being used for the renewal of the entire apron on the south side, with the exception of the 100 ft. of oak, and for the replacement of about 160 ft. of the apron deck on the south side. This material was furnished in 4-in. by 10-in. pieces and was applied in essentially the same manner as the decking on the interior of the pier.

Application of the greenheart decking was confined to about 125 ft. of the south apron. This material was supplied in 2-in. by 8-in. pieces, and in order to avoid irregularities in the surface of the apron it was laid on a 2-in. filler of creosoted pine planks. At the out-shore end of the pier, where the apron is not used for trucking purposes, the deck was renewed with creosoted pine.

Applying Siding

In preparation for applying the siding, the studding, bracing and posts were renewed as required, using creosoted pine timbers. The siding, consisting of about 40,000 ft. b.m. of 1-in. by 6-in. standard pine drop siding treated with chromated zinc chloride, was then applied and painted with three applications of standard medium gray paint. Pine treated with chromated zinc chloride was also used for renewing the rolling doors in the exterior walls. As already stated, the new window frames and sash, the latter being of the fixed type, are of pine treated with Permatol "A." These parts were given a primer coat of lead and oil at the factory and two coats of lead and oil in the field. The work carried out in 1938 included renewal of all sash except that in the sides of the high bay in the roof, which will be replaced in 1939.

Work on the substructure of the pier involved the renewal, as needed, of the piles, sway bracing and caps, using creosoted pine members. In this work the new piles were driven from the upper level of the pier by a gasoline-powered driver operating on rollers. Other noteworthy features of the substructure work included the use of spike-grid type timber connectors at the connections between the sway bracing, piles and caps and the use of ¾-in. galvanized bolts at the same connections, to minimize the effect of corrosion.

All work in connection with the repair of Pier 4 was done by the railroad's regular forces, with the single exception of the driving of the piles, which was done under contract. As an aid to economical prosecution of the work, a variety of power equipment was utilized, including a portable air-operated saw, an air-operated wood-boring machine, which was used principally for boring bolt holes in the foundation sway bracing, piles and caps, and a hand-held electric drill for boring spike holes in the ends of the gum planks. Air for the operation of the pneumatic tools was obtained from the local shop supply. Wherever the work required the cutting or dapping of treated timbers, the exposed surfaces were treated with a brush application of the proper preservative, this practice being followed for salt-treated as well as creosoted timbers.

Details of Treatment

In the treatment of the black gum decking with chromated zinc chloride, most of the material was given a retention of 1 lb. of preservative per cubic foot. Part of this material was treated green, part was seasoned from three to five months before treatment and a small amount was kiln dried both before and after treatment. The treatment was carried out at a pressure of 175 lb. per sq. in. and at a temperature of about 150 deg. F. The pine siding was treated with ¾ lb. of preservative per cubic foot at the same temperatures and pressures as were applied in the case of the black gum. The siding was either air seasoned or kiln dried before treatment and was kiln dried after treatment.

That part of the black gum decking that was treated with Wolman salts was given an average net retention of 0.3 to 0.33 lb. per cu. ft. of dry preservative. This material reached the plant in various stages of dryness, but it was all green enough to warrant steam seasoning before treatment. The average steaming cycle covered two periods of 5 hr. each at 10 lb. per sq. in. (240 deg. F.), with a vacuum period between each steaming period and between the last steaming period and the introduction of the preservative. The latter was maintained at a temperature below 165 deg. F. throughout the treatment and the degree of concentration varied between 1.5 per cent and 1.75 per cent, depending on the moisture content of the wood in the charge.

The maximum pressure reached during the treatment with Wolman salts was 175 lb. per sq. in. and the average pressure period was approximately four hours. After treatment, this material was dried in cross-circulation kilns to a final moisture content below 30 per cent, the average kiln schedule being 18 days. Pene-

tration of the preservative in the gum was reported to be comparable to that obtained with pine.

Treatment of the pine sash with Permatol "A" was carried out in accordance with instructions issued by the Western Pine Association. This preservative, which contains Pentachlorphenol, pine oil or other solvents, a spreader and a penetrant, was developed by the Western Pine Association especially for use in treating sash and other millwork.

A further application of wear-resistant woods has been made in the passenger platform at the Newport News station. This platform is subjected to rather severe service and when renewal became necessary in 1937, a portion of the decking was replaced partly with 3-in. by 10-in. ship-lap gum treated with chromated zinc chloride and partly with 3-in. by 9-in. greenheart planks. Further applications of salt-treated timber are involved in renewals of the aprons, pier floor and substructure of Pier No. 5, which work is now in progress, and also in similar work on a minor scale at Pier No. 8. For fastening the floor planks on Pier 5, ⅜-in. by 8-in. spikes of the "double-grip" type are being used. These spikes require drilling of the planks to prevent splitting of the wood, but it is felt that they insure an increased grip for holding the planks to a uniform surface, which is considered desirable.

Uses Novel Method for Locating Lost Bridges

TO locate two steel bridge spans that were carried away and buried or submerged during last year's floods in New England, the Boston & Maine resorted to a novel method of detection which involved the use of instruments for recording deflections of the normal magnetic lines of the earth. Using this method, both of the lost spans were located quickly and with a high degree of accuracy.

The two bridge spans involved, each consisting of two plate girders and their attachments, formed parts of two different structures on the double-track main line of this company's Fitchburg division. One of the spans formed part of a bridge across the Otter river at Otter River, Mass., while the other comprised part of a structure across the Millers river at Erving, Mass. In both cases the spans were carried downstream by high water and disappeared from view, that at Otter river being buried while the other span was submerged in the Millers river.

The method that was used for locating the lost spans was based on the fact that the magnetic lines of the earth, which are normally in the vertical plane of the magnetic north, would, within a limited distance from the span, be drawn toward the buried structure.

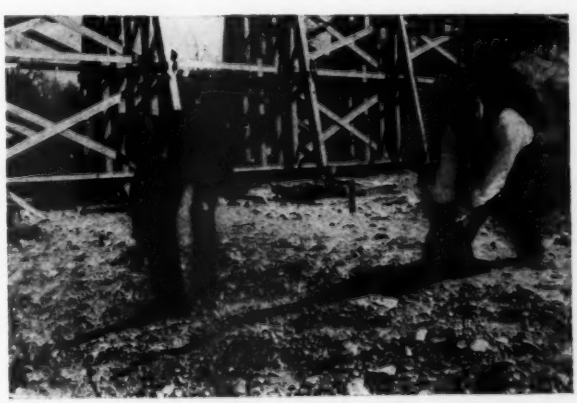
Hence, on the surface of the ground (or water as the case might be) within a limited area around the buried span, the magnetic lines would have a distorted aspect. At some distance from the metal the horizontal component of the distortion would be the greater while at points nearer to or directly over the span the vertical component would be the most pronounced.

Consequently, it was decided that a compass would be most useful in locating the general vicinity of the buried span, while a dipping needle would be best suited for obtaining the exact location. Experiments disclosed the fact that a compass needle is visibly affected if brought within five feet of an engine truck.

Any sensitive compass will serve the purpose; in this case a small marine compass was used. The dipping needle that was used was of the type that is known as a miner's compass or box finder. Instruments of this type are used generally for locating ore deposits, pipe lines and buried box covers. In addition to its function as a dipping needle, the box finder can also be held in a horizontal position to act as a compass, but in the work of locating the bridge members it was considered advantageous to have two observers, one with a compass and the other with a box finder, particularly because the latter is most effective when held in a plane parallel with the compass needle.

Using this equipment, the areas where it was suspected that the bridge members were located were traversed systematically on north-and-south lines about 10 ft. apart. At the Otter River location an area was soon found where deviations were noted. These were carefully plotted and a central point was located. At this location a ditch was excavated, also in a north-and-south direction, and as the excavating work proceeded the instruments were frequently brought into use so that the nature of the indications could be observed as the span was approached and the digging work governed accordingly. At the three-foot level the lost span was located, although a careful visual inspection of the area had failed to disclose any surface indication of the presence of the structure.

After the span at Otter river had been located, the operations were transferred to the Millers River location. Here it was suspected that the span was submerged in the river and a boat was used for making the search, its position being maintained by lines secured to piers. Again an area was found where deviations of the needles occurred, and soundings made at this location disclosed the presence of the span on the bottom of the river.



The Method Employed for Locating the Lost Bridges Required Two Observers, One With a Compass and the Other with a Dipping Needle

This method of locating lost bridge members was devised by Laurence Richardson, mechanical assistant to the vice-president and general manager of the Boston & Maine, to whom we are indebted for the information contained in this article.

Bringing a Hillside Stream Under Effective

In dealing with a troublesome hillside stream at Maiden Rock, Wis., the Chicago, Burlington & Quincy collaborated with village and county governments in the construction of masonry dams, side walls and flumes, which were built for permanency and in accordance with designs that involve a number of interesting features. Details of this work are described in this article

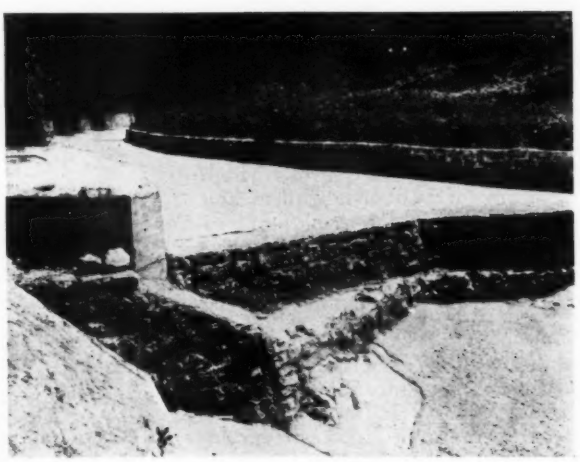
STEEP hillside waterways that are normally dry but which carry large quantities of water and debris during heavy downpours have long presented a problem on those railroads with tracks located at the foot of high bluffs. Such has been the case on the La Crosse division of the Chicago, Burlington & Quincy, which lies along the east bank of the Mississippi river for practically the entire distance of nearly 300 miles between Savanna, Ill., and St. Paul, Minn. Drawing on many years experience with troublesome hillside streams on this line, during which various more or less temporary measures of control were applied, the railroad, in dealing with a particularly trying situation at Maiden Rock, Wis., joined with the village and county governments involved in the construction of a permanent control system which was designed, located and built in accordance with exact engineering principles and only after a most careful survey of all of the conditions and requirements of the situation.

The New System

Essentially, the new system consists of stone masonry dams located at strategic points in the upper reaches of the stream for the purpose of retarding the velocity of the water and reducing its carrying and scouring power, and of flumes in the lower portion of the stream, whose purpose is not only to prevent erosion but to permit the water to travel at the maximum possible velocity so that the rate of deposition is reduced where it would be most troublesome. To prevent the erosion and undermining of the banks of the stream, stone masonry walls are provided at various points, particularly along the concave sides of curves.

The new system was built to control a creek at Maiden Rock and was constructed largely in 1935, although additional work of a limited character was done by the Public Works Administration in 1936-37.

Where it borders the Mississippi river, the Burlington line lies at the base of the high bluffs that rise above the river on the Wisconsin and Illinois side. At intervals the bluffs are pierced by steep-sided wooded ravines in which the over-burden on the slopes consists of a mixture of black soil and stone fragments which range in size up to large boulders. These hillside streams as a rule are fed by relatively small drainage areas and hence normally do not carry a continuous flow. But, since these side slopes and stream beds are on steep gradients, the run-off is exceedingly rapid during heavy downpours and as a consequence the flows have a large capacity for scouring and for carrying debris. Since the slopes flatten out somewhat



Looking Upstream at Dam No. 1, Showing the Grouted Masonry Bank Walls Above It

Carried Longitudinally Beneath a Street for Approximately 800 Ft., the Creek Passes Under the Railroad in a 6-Ft. by 6-Ft. Concrete box

Control

Above — Looking Upstream From Dam No. 1A Toward Dam No. 2, Showing the Silting Basin Which Lies Between Them

Left — Looking Downstream From the Highway Arch, Showing the Grouted Apron and Masonry Walls

as they approach the track, the stage is set not only for wash-outs and related difficulties, but also for the silting of drainage openings and the deposition of debris in troublesome locations on or about the property of the railroad and on the village streets.

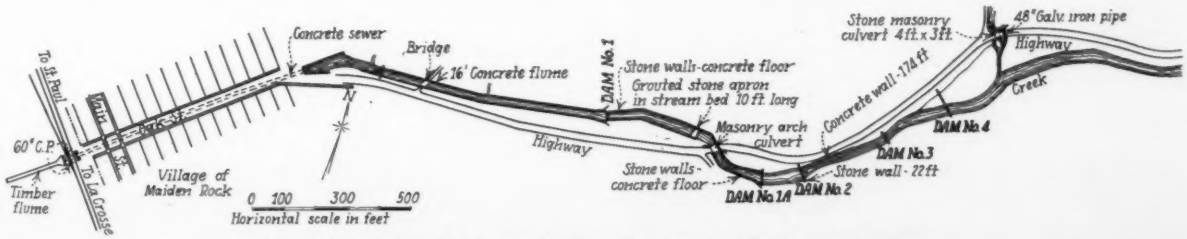
Early Control Measures

The first control work done at this location consisted of a rock dam which was built in 1918 and which still stands. This rock dam was later supplemented by dams constructed of rocks, logs and brush at intervals in the stream bed for the purpose of lowering the gradient and thereby reducing the rate of flow in the stream. Such dams proved of benefit for a time but rotted or were washed out eventually. Next loose rock dams and splash aprons were tried but, while they proved to be more effective and longer lived than the log structures, they too, were usually destroyed when subjected to exceptionally heavy flows.

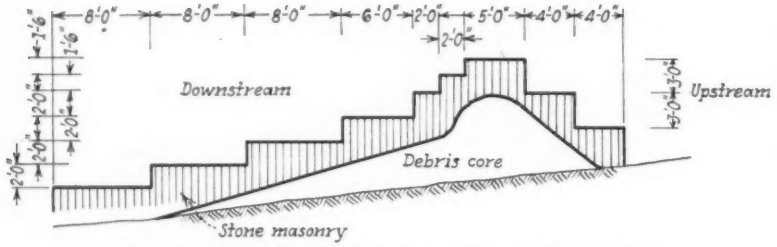
Following this experience with log and loose rock dams the railroad resorted to mortar-bound stone-masonry construction, first in a small way but later, as the dry-wall dams continued to fail, on an increasingly greater scale. Hence, dams embodying this type of construction have been built in a number of troublesome hillside streams, the latest installation being that at Maiden Rock. But the main dam in this installation differs from previous installations in the fact that it was designed to take care of a much larger run off of water.

The situation at Maiden Rock was such as to call for a high degree of ingenuity in overcoming the difficulties that it imposed. Throughout the greater portion of its length, the stream bed of the creek, which extends generally in an east and west direction, has an average grade of slightly less than five per cent and shows only a slight tendency to flatten out as it approaches the railroad tracks. The stream has a drainage area of about 937 acres, and where it has cut a channel through the bluff, the side slopes are on average grades of about 30 per cent. For the most part, it follows a moderately tortuous course, thereby setting the stage for scour and the undermining of the banks at bends in the stream. As it consists largely of a mixture of fine soil and stone fragments of various sizes, the material of which the banks are composed is relatively unstable and lends itself readily to scouring action. In this process the fines are first washed away, causing the stones to drop into the stream, and so swift has been the current at times that in one case it was reported that a boulder having a volume approximating a cubic yard was rolled along by the current for a considerable distance.

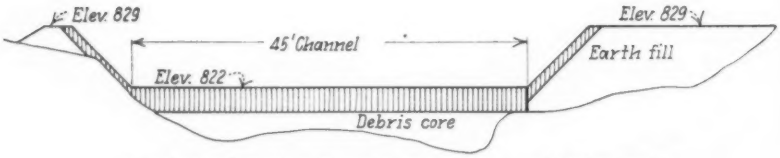
Near its lower end, the stream extends directly through the middle of the village of Maiden Rock, is then carried under the double-track line of the Burlington and empties into the Mississippi river only a few hundred feet from the tracks. Formerly the



Plan of the Creek at Maiden Rock, Wis., Showing the Locations of the Dams



This Cross Section is Typical of the Dams at Maiden Rock



Longitudinal Section Through Dam No. 4 at Maiden Rock

stream was carried through the village in an open ditch, which extended along Oak street, but years ago an underground sewer nearly 800 ft. long was constructed along the center of the same street for the purpose of removing the flow from the surface. This sewer is partly of circular-brick construction and partly of reinforced concrete.

To permit the flow in the stream to attain the maximum possible velocity before entering the sewer so that the deposition of material in the latter would be reduced to a minimum, a concrete flume, 16 ft. wide, was constructed in the stream bed for a distance of 670 ft. above the upper end of the sewer. At its upper end this flume terminated at a dry-wall dam which had been built previously by the village. As a part of the stream control project this dam has been improved, as described later, and is known as Dam No. 1. The water that passes through the sewer during flood stages of the creek moves under such a high velocity head that it formerly was not uncommon for the concrete slabs that form the roof of part of the sewer to be raised out of position by debris which choked the flow.

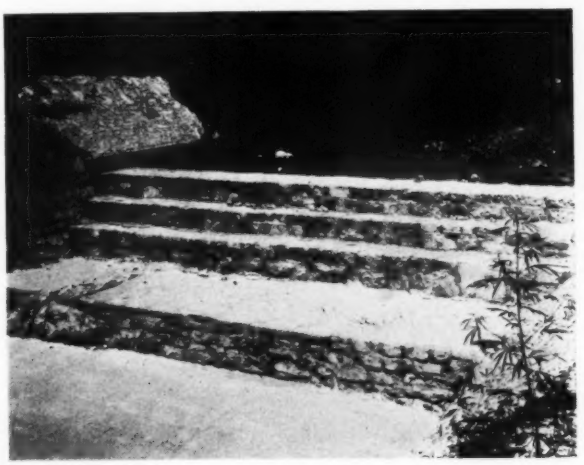
How the Railroad Suffered

At its lower end the sewer empties directly into a 6-ft. by 6-ft. concrete box which extends under the railroad tracks. For carrying surface water under the tracks a 60-in. concrete pipe is provided on each side of the box. The grade of the stream bed flattens out abruptly just below the tracks so that at this point a marked reduction takes place in the velocity of the flow, causing the stream to deposit large quantities of the debris that it carries. To speed up the flow as much as possible, the railroad constructed a timber-lined flume 200 ft. long below the tracks. Nevertheless the stream continued to deposit such large quantities of material at the outlet of the flume that it was frequently necessary to remove the accumulation with a dragline in order to keep the stream open, and the deposits were so heavy at times as to cover the tracks and interfere with the operation of trains.

As an indication of the velocity with which water passes through the sewer and the concrete box, it is interesting to note that the abrasive action of stones passing through the box has been such as to wear away the concrete and to rupture the reinforcing bars in the floor and the lower portions of the side walls of the box. To protect against further damage of this character these portions of the box are now lined with sheet metal obtained from old steel coal cars.

Another object of damage by the stream has been a county highway which, extending easterly from the village, follows the stream on the south side to a point about 2,200 ft. from the tracks, where it crosses to the north bank over a 14.3-ft. by 8-ft. masonry arch culvert, and continues easterly, following closely the north bank of the stream. During the course of its passage through the ravine, the highway intersects a number of tributary drainage courses which are carried under the roadway through culverts.

Not only has this highway been menaced at several points because of changes in the bank of the stream but



Close-Up of Dam No. 2, Which is Typical of the Stepped, Grouted Masonry Construction That was Used

Looking Across the Top of Dam No. 4, Showing How the Erosion Caused by Heavy Storms Had Filled the Stream Bed Above It Level with Its Crest

the masonry arch culvert was subject to overflow during heavy rains. To prevent the undermining of the stream banks at points where this process was endangering the highway, the county had constructed concrete or stone masonry walls at a number of such locations. At the culvert, as a means of facilitating the movement of water through the opening, the city paved the stream bed through the culvert and for a short distance each way and built stone masonry walls along the banks in this vicinity, giving a flume effect.

As the premise for its design, the railroad decided that the stream could be brought effectively under control if the maximum velocity of the water could be limited to 10 ft. per sec. At this velocity it was felt that the capacity of the flow for carrying debris would be effectively reduced. With this figure in mind, therefore, the railroad undertook the design and location of the dams necessary to bring about the required reduction in the stream gradient, all calculations being based on a maximum anticipated discharge of 1,800 cu. ft. per sec.

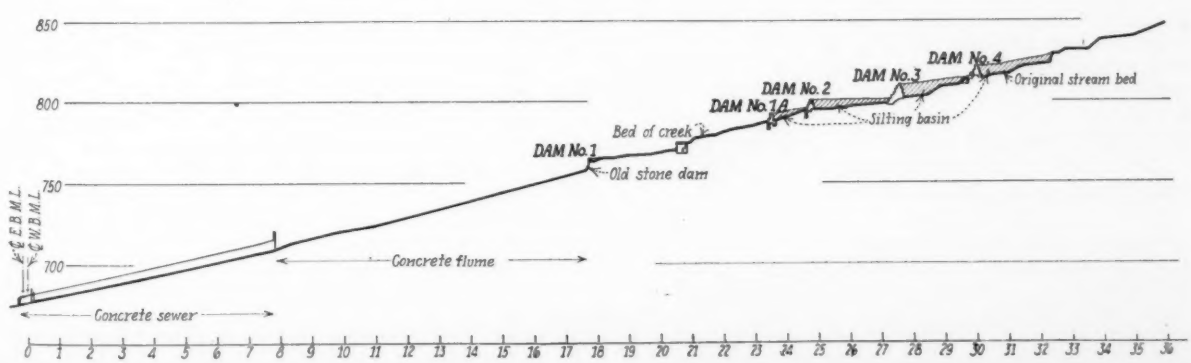
The Rugged, Rocky Upper Reaches of the Stream Released Tons of Material with Every Storm, Which Was Carried Down to Damage the Village and the Railroad

Looking Downstream From Just Above Dam No. 2, Showing the Filled-In Flattened Creek Bed Extending to Dam No. 1A, Immediately Ahead

Preliminary to the design and location of the dams a careful survey was made of the stream, which included the running of a profile of the stream bed and the taking of cross-sections of the channel and part of the ravine. From these survey notes the dams were tentatively located in the office. The proposed site of each dam was then inspected on the ground and the location was altered if this was considered desirable in the light of conditions as they were found at that time. In locating the dams, consideration was given to the need for placing them at points downstream from locations showing evidence of scour so that the formation of the pools would have a tendency to check further damage to the banks. A second consideration in locating the dams was the desirability of holding the quantities of material required for construction to a minimum.

Four Dams Constructed

After the dams had been thus located, accurate cross sections were taken at each site and from these and previously compiled data a contour map was made of the stream for some distance above the highway bridge. The dams and the wing walls or dikes that were constructed in connection with them could then be plotted accurately on the contour map. Four new dams were constructed, of which that farthest downstream is located about 200 ft. above the highway bridge and is known as Dam No. 1A. Dam No. 2 is located about 120 ft. farther upstream, and is followed by Dam No. 3 at a point 280 ft. farther up the ravine. Dam No. 4 is located 227 ft. from Dam No. 3. Each dam is of such a height that its crest is approximately at the elevation of the base of the next dam upstream. Hence, when the silting basins behind the dams have become filled with debris, and this was expected to occur during the first heavy rain or two


850
800
750
700
E.E.B.M.L.
W.B.M.L.
DAM No. 4
DAM No. 3
DAM No. 2
DAM No. 1A
DAM No. 1
Original stream bed
Silting basin
Bed of creek
Old stone dam
Concrete flume
Concrete sewer
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

Profile of That Part of the Stream at Maiden Rock, Wisc., Affected by the Flood Control Works

after the completion of the dams, the profile of the stream will present a stepped effect. In addition to the construction of the four new dams, Dam No. 1, which is located about 375 ft. downstream from the highway bridge, was increased in height about 3 ft. and the old dry wall construction was grouted.

Each of the new dams has a height above the stream bed approximating the depth of the channel but the dams are given an effective length somewhat greater than the width of the channel by means of wing walls or dikes which, in each case, rise 7 ft. above the crest of the dam. Thus the dams act as wiers or spillways. The crests of the dams vary in height above the stream bed, from 4 ft. for Dam No. 1A to 10 ft. for Dam No. 3, and the spillways vary in length from 30 ft. at Dam No. 1A to 45 ft. at Dam No. 4.

Dams Have Stepped Faces

But the outstanding feature of the dams is the cross section that was adopted as a means of dissipating by degrees the energy of the water flowing over them. As shown on the accompanying typical cross section of the dams, the width of the crest in each case is 5 ft. On the downstream side, the face of the dam is in the form of a series of steps, of which the first two below the crest are 2 ft. wide and 1 ft. 6 in. high. All the remaining steps are of equal dimensions, being 8 ft. wide and 2 ft. high. This type of construction renders unnecessary splash aprons at the downstream bases of the dams, but in a number of cases curtain walls were provided to prevent undercutting. On the upstream sides of the dams the faces consist of steps 4 ft. wide and 3 ft. high, designed to stabilize the dams until such time as the silt fills up behind them.

All the dams are of stone masonry construction, embodying a brown limestone which was obtained locally, and have debris cores. The dikes consist of earth embankments with 2-to-1 slopes on both sides and are faced on the upstream slopes with grouted riprap 1 ft. thick. In all cases, the dams are securely anchored in the banks and bed of the stream.

Other Work Undertaken

In addition to the construction of the four new dams and the raising of Dam No. 1, work that was undertaken during the recent program includes the raising of an existing stone wall along the south side of the stream from a point a short distance above the highway bridge to Dam No. 1A; the construction of a grouted stone wall 7 ft. high and 30 ft. long along the north bank of the stream at the lower end of the flume through the highway bridge; the construction of a grouted stone apron 10 ft. long in the stream bed at the same location; and the installation of a 48-in. galvanized pipe with stone masonry headwalls and wing walls to supplement a 4-ft. by 3-ft. stone masonry culvert that carries one of the tributary streams under the highway.

In 1936-37, subsequent to the completion of the foregoing work, additional protective measures were undertaken with PWA funds. These included the raising of Dam No. 1A two feet, the construction of a concrete floor in the stream from this dam downstream to the upper end of the flume through the highway bridge; and the construction of a flume 16 ft. wide from Dam No. 1 upstream nearly 300 ft. to a junction with the downstream end of the flume through the bridge.

The success of the entire stream control system has been thoroughly demonstrated in several storms of unusual severity which caused serious washouts at other points on the line, and in which the system at Maiden Rock functioned properly with no damage to any of the property of all three of the agencies involved. As the silting basins behind the new dams become filled, it is anticipated that it will be necessary to construct additional dams farther upstream. In fact, plans have been drawn for at least one additional dam in the main channel and for a dam in one of the tributary streams, and it is considered that before this plan is 100 per cent complete additional dams will eventually need to be built further upstream.

The work of designing and constructing that part of the control system in which the railroad participated was carried out under the general supervision of A. W. Newton, then chief engineer of the Burlington, and C. L. Persons. Mr. Persons, at the time assistant chief engineer of the road, is now assistant to executive vice-president of the Burlington Lines. L. W. Skov, hydraulic engineer, designed the dams and the control works in general, while W. J. Harris, division engineer of the La Crosse division, was in active charge of the survey and construction work.

Damaged Switches Cause Two Serious Train Derailments

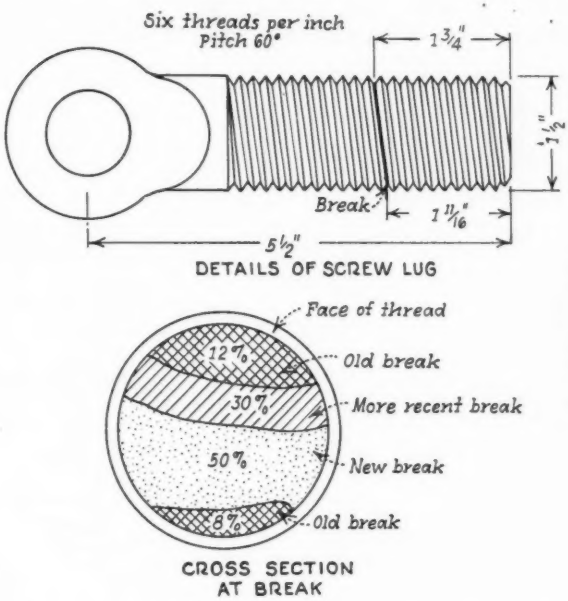
ON February 7, a freight train on the Central of Georgia was derailed at Sargent, Ga., resulting in the death of three employees. This accident occurred on the Cedartown district, a single-track line which extends from Griffin, Ga., to Cedartown, upon which there are no automatic signals. At Sargent there is a side track 2,811 ft. long on the south side of the main track, the easterly 1,250 ft. of which is utilized as a house track while the westerly 1,561 ft. is a passing siding, the easterly entrance to the latter being through a facing-point crossover for westbound trains. The evidence taken at the investigation and reported by the Bureau of Safety, Interstate Commerce Commission, from which report this information is abstracted, indicated that No. 29, a westbound freight train, met an eastbound freight train, No. 38, at Newman, 7.2 miles east of Sargent, and that at this point the conductor of No. 38 notified both the engineman and conductor of No. 29 that his train had had a brake beam down near Gloverton, about 3 miles west of Newman, and suggested that they look for a defective switch at Arnco, about 1½ miles west of Newman.

The engineman of No. 29 testified that as a result of this warning he reduced speed to about 2 miles an hour at Arnco and satisfied himself that this switch was in good condition before passing over it, but that while passing Sargent at 25 to 30 miles an hour he was derailed at the east switch of the crossover. His examination of the switch after the accident indicated that some dragging object, apparently on an eastbound train, had bent the bridle rods upward and eastward enough to open the points, although the switch stand was closed and locked for the main-track movement and the target displayed a green aspect.

Further testimony indicated that

something had been dragging all the way from Cedartown, approximately 60 miles west of Sargent, marks being visible on all highway crossings between these points; there were marks on all turnout rails at Clem, 12.4 miles west of Sargent; there were fresh marks made by dragging equipment on the ties for 6.5 miles west of Sargent; and one

In its discussion of the accident, the Bureau called attention to the fact that although it was daylight and clear, and that although the brake beam became defective soon after leaving Cedartown, it was not discovered for more than five hours, during which time the train traveled 63 miles. Furthermore, the conductor did not notify the dispatcher for



Above — A Sketch Side View of the Screw Lug Which Broke Near Marmet, W. Va. Below — A Sectional View of the Break, Showing the Progressive Character of the Fracture

end of a guard rail at an underpass had been torn loose at Whitesburg, 5.2 miles west of Sargent. About 2¾ miles east of Sargent one of the brakemen, while walking over the train, noticed dust coming from under one of the cars and signaled the section foreman who was working at this point to look under the train. The foreman immediately gave stop signals and the broken brake rigging was removed. The brakeman went back to Gloverton and examined the switch at that point but made no further examination of the track.

The foreman testified that he did not go back and make an inspection for possible damage, as he had never been instructed to do so when a brake beam had been found down. After notifying the crew of No. 29, the conductor of No. 38 wrote a message relative to the defective brake beam but did not file it until two hours after his arrival at Newman, his explanation being that he was occupied at a warehouse some distance from the telegraph office. Again, although there was a telephone at the warehouse enabling him to call the dispatcher, he did not consider it necessary to do this, as he had already notified the only westbound train in the vicinity and knew that no regular trains were due.

more than an hour after the accident, which might have been averted if he had done so upon his arrival at Arnco. The section foreman had ample time to patrol his track and to flag No. 29 after the brake beam was discovered, but failed to do this because he had never been instructed to make such an inspection behind a train after a brake beam had been found to be dragging.

Passenger Train Derailed

The second accident was a derailment of a passenger train on the Chesapeake & Ohio, near Marmet, W. Va., on December 30, in which 35 passengers and 3 employees were injured. In this case an eastbound freight train, consisting of 134 cars and a caboose, had cleared No. 2, the George Washington, an eastbound passenger train, at Marmet. The passenger train was derailed, and some of the equipment was badly damaged, at the west switch of the passing siding, while traveling at a speed of 60 to 65 miles an hour.

In its report of the accident, from which this is abstracted, the Bureau of Safety stated that the facing point switch at the west end of the passing siding apparently opened after the engine, tender and first car in the train had passed over it, although it was lined for the main track and the automatic signals protecting the block in which it was located had both displayed proceed indications.

The switch stand involved was installed new in 1929, and a new crank eye-stud or screw lug was applied to the stand in April, 1936. After the accident it was found that this lug was broken, and that one part of it and the connecting rod were lying on the ground under the stand. The breaking of the lug apparently allowed the switch point to open enough to cause the derailment of the rear truck of the second car, forcing the point to the south, thus permitting the following cars to enter the siding. The switch stand in question was a Duro low, hand-operated stand, having a rigid connection between the stand and the switch. The operating crank shaft was fastened to the connecting rod by means of an adjustable crank-eye or fully threaded lug, 1½ in. in diameter by 5½ in. long from the center of the eye to the end of the threads, which screwed horizontally into the vertical operating crank shaft, thus permitting adjustment of the switch point.

It was testified that between 1932 and 1936 a number of failures had occurred in these threaded lugs as a result of fractures, but that these were generally in yard switches, with a few in main-track switches in yard limits. It had been impossible to determine definitely whether the fractures were caused by the switches having been run through or from some other reason. Yet, because these failures had raised some doubt as to the safety of the threaded lugs, about 3,000 had been replaced subsequent to April, 1936, and a switch stand with a non-threaded type of lug had been adopted.

Examination of the broken lug indicated that the fracture had occurred in successive stages, there being two distinct cracks at the bottom of the threads 1¾ in. from the screw end, the surfaces being discolored, indicating old breaks that covered 20 per cent of the cross section. A more recent break covered 30 per cent of the area; and the remaining 50 per cent was a new break. The Bureau stated that a progressive fracture took place which could not be detected by regular inspection, and that the final fracture was a clean break, with no evidence of bending or permanent deflection prior to the final fracture. The conclusion of the Bureau was that the accident was caused by the switch opening under the train as a result of the broken switch lug.

A Fixed Time for Tie Renewals

Should tie renewals be started at a fixed time? If not, why? If so, when and how is this determined? Should the date of completion be fixed? Why?

Get Them in Early

By P. O. Ferris
Engineer Maintenance of Way, Delaware & Hudson, Albany, N.Y.

In answering these questions, one must qualify the answers because locality and weather conditions play an important part in the starting time for tie renewals. Some railways, and some parts of others, have no freezing weather to contend with, while on other lines or parts of lines, the roadbed may be frozen solid for as much as five months or more. Roads like our own, with a long winter season, may have a late spring that will retard tie renewals one year, compared with another, by as much as three weeks. Again, frost leaves the ground on the most southerly division on this road almost three weeks before it does on the most northerly division. For these reasons, it is difficult to adopt a fixed time for starting tie renewals on the road as a whole.

After ties are spotted and checked for renewals and allotments have been made, installation should be started and this should be as early in the spring as weather will permit, after shims, if any have been necessary, have been removed and the surface has been corrected. Since spot renewals disturb the surface to some extent, it is impractical to do much general surfacing until after or during tie renewals, since time would be wasted tamping ties that are to be removed later.

If possible to do so, I believe that it is a good plan to have tie renewals completed by July 1. There are decided advantages in so doing. If the ties are dug in, trenching can be done much easier prior to this date, especially in ballast other than crushed rock, for the roadbed has not yet dried out entirely. Again, men work much more effectively before the weather becomes hot. Furthermore, there is less probability that the track will buckle than during the hotter weather, in case it may be disturbed improperly. If rail is laid during the spring, early tie renewals insure that it will be properly and promptly supported on sound ties with smooth surface and line. Smoother-riding track is also assured ahead of the summer passenger schedules if tie renewals are out of the way by July 1 or sooner. Finally, by having the tie renewals completed and the old ties disposed of by this date, the track forces are released for weeding, mowing and other seasonal duties.

Of Much Importance

By J. B. Kelly
General Roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Stevens Point, Wis.

In the territory in which I am located, the time of starting and completing tie renewals is of such importance to the general welfare of the track that the timing of the whole program, including these dates, is a matter of good policy. Satisfactory results are being obtained by making the following allotments: April, 15 per cent; May, 35 per cent; June, 30 per cent; July, 15 per cent; and August, 5 per cent; these figures representing the monthly percentages of the total tie allowance for the year.

Tie renewals should not be prolonged beyond August and, where the forces are sufficient to do so and keep abreast of other necessary work, it is advantageous to dispose of 95 per cent of the allowance by June 30. The remainder can then be kept available for the replacement of doubtful timber up to the latter part of August, but should be used by the end of that month.

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in August

1. *What practical methods can be employed, when laying rail, to reduce the destruction of ties?*
2. *Where water under pressure, but no sewer, is available, what provision can be made for sanitary toilets in stations? What features should be given special attention?*
3. *What are the advantages, if any, of oiling rail joints periodically? How should this be done? How frequently?*
4. *How frequently should steel spans be inspected? What details should be examined?*
5. *What are the advantages and disadvantages of giving a portion of the track on each section a thorough overhauling every year?*
6. *To what extent is it practicable to use welded pipe for hot and cold water and steam lines? What are the advantages? The disadvantages?*
7. *What are the relative advantages of flat-bottom, corrugated and ribbed tie plates? The disadvantages?*
8. *What preliminary work should be done before painting a building? Why? By whom should it be done?*

It has been shown conclusively that early renewals, commencing as soon as weather and roadbed permit, will aid every function of maintenance. Early renewals insure better support to the track throughout the year, resulting in less surface and line difficulties, less tendency for the rail to creep and extension of the life of all ties by reason of equal support to the rail through early removal of old ineffective ties and the substitution of sound timber.

On the other hand, ties placed late in the season do not, under ordinary conditions, give relative support and in many instances remain in a loose, churning condition throughout the winter, and may be singled out as responsible for failure in rail, fastenings and the track in general. Late unorganized tie renewals interfere with the proper handling of other track work to such an extent that results for a given expenditure may not be nearly so satisfactory as if the ties had been renewed early. This, together with the added cost of placing the ties when the ballast section has solidified, in many cases doubling the expense, leaves no justification for delaying tie renewals.

Ballast Works Easier

By W. Allan
Section Foreman, Canadian Pacific, Montreal, Que.

Although the time varies with the latitude, tie renewals should be started as early as weather and frost permit. In this latitude May is the month when track repairs should be pushed steadily. The frost leaves the ground late in April, the track becomes dry and heaved spots settle back to their old elevation. If there are any poor ties in the track they will show up at this time, and such weak spots as develop from this cause should be attended to at once.

As soon as these worst spots have been given attention, the foreman should go over his track, correcting irregularities in line and surface that have developed over winter. This work should, in general, be completed by May 1, so that he can devote practically all of May to tie renewals. This work should be prosecuted continuously, except where corrections in line and surface become necessary.

Tie renewals should have the right of way at this time, for the ballast, particularly gravel and cinders, is loose and easily worked. In addition, the weather is generally cooler and higher production per man-hour can be expected than during hot weather. Furthermore, the ties that are put in early will have a solid bearing long before winter and can be depended on, so far as keeping the track smooth is concerned.

In other words, every foreman should consider that when he is renewing his ties he is actually getting ready for winter, and that the earlier this part of the work is off his hands, the better his winter track will be.

Schedule Is Desirable

By L. A. Rape
Section Foreman, Baltimore & Ohio, Crothers, Pa.

Theoretically, a schedule for tie renewals is desirable, for up to a certain point it puts the work on a systematized basis, which is always preferable to a hit-or-miss operation. Practically, however, there are many difficulties in the way of carrying out a schedule. A late or wet spring may throw the schedule out of gear at the start; failure to get ties when needed, a low labor allowance, a scarcity of labor or other factors may retard progress on the schedule; heaved track, dirty ballast, trouble with drainage or other causes may hold one section back, while the reverse of these conditions may allow another to proceed with its renewals several weeks earlier.

Despite these difficulties it is not debatable that tie renewals should be started as early as conditions permit, and that the track forces should devote as much of their time as possible to this work with the view of completing them by the first, or, at latest, the middle of July, that is, before steady hot weather sets in. This will not only result in greater productive capacity per man-hour, but will give the ties ample time to get their beds solidified to insure good riding conditions during the winter. Early tie renewals almost invariably decrease the accident rate, compared with tie renewals during extremely hot weather.

Complete by August 31

By W. Woolsey
Section Foreman, Illinois Central, Chicago

Tie renewals should be started not later than May 1 and completed by August 31 at the latest, but as much earlier as conditions will permit. While renewals can sometimes be started earlier, this date usually gives ample time for removing shims, smoothing the track and touching up the line, where needed, tightening bolts, cleaning rubbish and other jobs that should be out of the way before the major work of renewing ties is started. The date of completion, August 31, also gives sufficient time to go over the track, smoothing line and surface, in preparation for winter, tightening bolts, cleaning the right of way, opening ditches, and the multitude of other jobs that must also be done in preparation for winter.

Filling Over a Concrete Culvert

Where a timber trestle is replaced with a concrete culvert, what period should elapse after the culvert is installed before the filling is started? What precautions should be employed in placing the fill?

No Hard and Fast Rule

By M. Hirschthal
Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N.J.

The period that should elapse after a concrete culvert is installed before filling can be placed will vary with a number of conditions which may surround the work. It will depend, first of all, on the type of concrete culvert that is being installed, that is, whether it is precast concrete pipe, cast-in-place pipe or a box culvert; if precast pipe, on the character of the mortar used for joints, and on the type of bedding; if cast-in-place pipe, on the kind of cement, whether normal, early-high-strength or low heat; then on the type of foundation supporting the culvert; and last but not least, on the character of the filling material and the height of the fill.

Because of the number of factors it is evident that a number of combinations may be present to affect the result, so that the decision cannot be made in accordance with a hard and fast rule. For instance, given a box culvert of high-early-strength concrete, founded on firm material, under a low fill of, say, 4 to 5 ft. of clay or sandy material, the work of filling may begin after a 24 to 48-hr. curing period, since the filling material is of a character that will protect the concrete and improve its curing.

On the other hand, we may have the other extreme of a culvert made with

normal cement, under a high rock fill, supported on a soil of such a character that it was necessary to spread the base slab to provide a safe bearing area. In this case it would not be safe to start the filling operation for at least 21 or possibly 28 days, depending on the results obtained from the test cylinders at these periods, during which time the curing of the concrete should have been completed. Between these extremes the several factors enumerated will determine the time necessary for safety in the filling operation.

In the case of the precast units, considerations similar to those applying to the main member will also apply to the mortar joints and where the bedding of the pipe is of concrete, the use of high-early-strength cement will be a factor in determining the length of time that must elapse before the filling material may be deposited on the culvert.

When the depositing of the fill is started, care must be exercised to place it nearly uniformly on both sides of the culvert, so as not to allow too great a difference of surcharge between the two sides; otherwise, an eccentric soil-pressure resultant will occur, causing excessive edge pressure on the low side, which may result in tipping the culvert. The same precaution should be taken longitudinally on any section of the culvert, for while the danger is not as great in this direction as transversely, there is still the possibility of exceeding the allowable soil pressure because of the eccentricity of the loading. This is particularly true on high fills, in conjunction with soil conditions where, either at the base of the foundation or at some lower stratum, the material may be unstable. Moreover, in the case of a rock fill of considerable height, care should be taken to reduce the impact effect of the deposit as much as can reasonably be done without too great expense.

Concrete Must Cure

By M. H. Lohr
Bridge and Building Foreman, Missouri Pacific, Coffeyville, Kan.

Time is required for concrete to set, but the amount of time that must be allowed before filling can be started will depend on the height of the fill, the character of the material and the method of placing, whether by teams, tractor and bulldozer, dump cars or wheelbarrows. If wheelbarrows are employed, the filling can usually be started as soon as the forms are removed. If the filling is to be done by the other means enumerated, the concrete should not be loaded until it has been allowed to harden for 28 days in the summer and 40 days in cold weather.

At least three feet of earth should be placed over the top and around the sides of the culvert before trains or tractors are allowed to pass over it or before the material is dropped from dump cars. With any method of filling, heavy stones or lumps of frozen earth should not be dropped on the culvert or allowed to roll against the side walls, for the impact may tend to crack the concrete. If high-early-strength cement has been used in making the concrete, the curing period can be shortened, but the exact interval will be determined by conditions surrounding the structure.

Painting Steel Sash

How frequently should steel sash in enginehouses and shops be painted? Wood sash? Why? What details should be given special attention?

Often Neglected

By E. C. Neville
Bridge and Building Master, Canadian National, Toronto, Ont.

The painting of sash in enginehouses particularly, and shops is a burdensome task, and is a constant problem to the officer responsible for their maintenance, not only because of the magnitude of the job, but because of the time and effort it takes to complete it. An enginehouse of 30 or 40 stalls contains many windows, and not a few shop buildings have comparable glass areas, and progress is usually quite slow, so that an excessive amount of time is consumed at a time when other work is pressing and the men can ill be spared. Because of variable temperature and excessive moisture during the winter and early spring, it is impracticable to do this painting except in the summer, for which reason it is often postponed from year to year until, finally, the sash has received serious or perhaps irreparable damage.

Metal sash corrodes rapidly under the atmospheric conditions at enginehouses and shops, where the air is charged with locomotive gases and moisture, and where dirt settles and holds moisture. For this reason, metal sash should be painted at least once every two years, but an annual cleaning and painting would be far better. At this time the sash should have not less than two coats, the first of which should be the best quality of red lead.

Wood sash can be allowed to run longer without painting, possibly four to six years, depending on the quality of material and workmanship at the last painting. In no case, however, should the interval be so great that the old paint is no longer providing some protection. Before painting, the putty should be tested and all loose, brittle, cracked and missing putty should be replaced, and both the old and new putty should be painted at the time the sash is painted.

Would Use Creosoted Sash

By General Inspector of Buildings

As most sash in enginehouses and some of them in shops are installed and maintained, they are "just a pain in the neck," to use a colloquial expression that seems best adapted for describing them. While steel sash are particularly adapted for the large window openings that are demanded in modern shops, and I do not criticize their use, they do give some trouble by reason of the corrosive gases with which the air around railway shops is usually so highly charged. Seemingly, the steel used for making these sash and frames has little resistance to the corrosive influences to which they are subjected, for rust is always active wherever the metal is exposed.

For this reason, steel sash in shops should be cleaned and painted annually, although it may be that painting in alternate years will suffice at some points where conditions are less severe. Even under these circumstances, however, the sash and frames should be gone over thoroughly once a year and all broken spots in the paint and all corroded areas should be cleaned thoroughly. The cleaned metal should then be given a coat of red lead, and this should be followed by a good protective coat.

Wood sash, while far more resistant than steel sash, has a much shorter life in enginehouses than in buildings where the exposure is less severe. Wood sash does not require cleaning and painting so often, but should be given attention at least every second year. They should be gone over annually, however, to make sure that the putty is sound and is performing

properly its function of holding the glass in place. Areas from which the putty has fallen soon show evidence of decay and within a relatively short time the sash will deteriorate to the point where replacement will become necessary, unless these matters are cared for.

Unfortunately, the painting of sash in enginehouses seems to be one of these items that are given least attention in repair programs. The painting of these sash is a slow, tedious and somewhat difficult job, which is generally pushed aside until other work is completed and in the final analysis is postponed from year to year, until conditions get so bad that something must be done, or until some "brass collar" comes along and demands immediate action.

Today, almost every road has facilities for preservative treatment available to it. There should, therefore, be no difficulty in obtaining treated sash and frames for use in enginehouses. So far, only a few roads have done this, but those that have testify to the benefits of doing so. In our own case we have used creosoted material in the construction of enginehouses and are committed to the practice. We have not used creosoted frames and sash for the windows, although I have advocated it strongly, because certain of our officers do not approve of doing so. I am sure that if we did many of our troubles would be eliminated.

Surfacing New Rail

Should the track be surfaced when new rail is laid? Why? If so, how closely should the surfacing gang follow the rail gang?

Surface Ahead of Laying

By G. S. Crites
Division Engineer, Baltimore & Ohio, Punxsutawney, Pa.

If slotted joint bars with prescribed tie spacing are in use, it will be necessary to give the track a surfacing lift immediately behind the rail gang, for that is the only way the ties can be respaced and damage to the rail prevented. With unslotted joint bars and uniform tie spacing, however, the procedure should be to put the track in good line and surface, square up and space the ties ahead of the laying of the rail. Then, if adzing machines are used, the tie plates will seat properly and the new rail will have a uniform bearing. There may be a few, but not many, loose ties; when these are tamped snugly to the rail, the new rail will ride much better than the adjoining old rail. A surfacing lift will not be needed unless ballast conditions demand that it be given.

The idea of surfacing track when new rail is laid is a hang-over from the days of slotted or dependent flanged joint bars, unplated ties, low joints and hand adzes. Then a mob threw the new rail into the track and a bigger mob followed to give the track a lift, to respace ties and to get the track ready for scheduled speeds. Much rail was damaged, irrespective of how closely the surfacing gang followed the rail gang, although it was the practice to shim the rail on low ties until the track was tamped.

Rail is the most costly part of the track, and its life in main tracks depends in large measure on the care with which it is laid. For this reason, the track and ties should be made right before the new rail is put down.

By All Means

By J. B. Martin
General Inspector of Track, New York Central, Cleveland, Ohio

By all means, the track should be surfaced when rail is laid. New rail requires a large investment, all of which is out-of-pocket cost, although certain credits are taken for the released rail. To conserve this investment, every precaution should be taken to protect the rail from damage, both at the time of installation and later. This can be done only if the application is made with the best of workmanship, to insure good gage, line and surface. Otherwise, the life of the rail will be shortened, and the riding qualities of the track will be below the standard of track in which these requirements are met.

The first surfacing should follow the laying closely and about 30 days later the track should be resurfaced, giving it a light lift out of face. This is particularly desirable where stone or other hard ballast is in service. This second surfacing should be done with power tampers to insure a thorough and uniform job of tamping. If the new rail has been surfaced properly, the track will ride smoothly and will require little attention for some time. The life of the rail will also be increased materially; in fact, enough to offset far more than the additional expense that will be incurred in doing a first class job of laying it and surfacing it properly.

Needs to be Surfaced

By Thor Monrad
Roadmaster, Northern Pacific, Columbus, Mont.

It has been my experience that, generally, new rail needs to be surfaced. If the track is checked closely after the rail is laid, small variations will be found in level, line and surface. Most of these variations existed in the old rail and were transferred to the new rail. In part, this may also result from the fact that the bearing of the new rail differs from that of the old rail.

Because of these variations, it is important that the track be surfaced to insure a better bearing for both rail and ties. If this is done, the track will ride more smoothly and require less maintenance. The surfacing gang should follow the rail gang as closely as this can be done without interfering with the work of either gang. Probably the space of one day's work will be about right. This interval will give ample time for the tie plates to become seated before the ties are tamped and thus will eliminate the probability of further settlement after the ties have been tamped.

Do Not Slight

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

So much money is involved in the purchase of new rail and the accessories now required, and in the labor of laying it, all of which is a direct out-of-pocket cost, that the best method of laying it and of caring for it after it is laid should be determined and then insisted on. Wheel loads are too heavy and train speeds are too high to warrant one taking any chances with respect to damaging the rail after it is in service, so that only those methods that will insure the best results should be chosen. Heavy rail, large tie plates and improved fastenings are now available to insure a high standard of track construction, but these are of little account unless the rail is given a solid and uniform bearing, and the best and heaviest rails can be damaged by loose ties, uneven level and poor gage.

It is my belief, based on long ex-

perience, that for best results on a road of dense traffic and fast trains, the roadbed should be widened, the ballast cleaned and the track surfaced, lined and gaged, before the new rail is laid. The new rail will then have a solid, even bearing, but even with the best of preparation, rarely if ever can good riding conditions be maintained unless the track is given a lift and a general surface, and is tamped with power tampers. The amount of this lift will depend on many conditions, including the depth and condition of the ballast and the interval since the last raise.

Effect of Oiling the Ballast

What effect does the spraying of the roadbed with oil to keep down dust have on the ballast? Is this effect permanent? Is the practice desirable from the maintenance standpoint? Why?

Varies with Kind of Oil

By B. R. Kulp
Engineer of Maintenance, Chicago & North Western, Chicago

The effects of spraying oil on the roadbed vary with the amount and kind of oil used and with the method of its application. In some of the earlier methods of spraying the oil on the roadbed, a perforated lateral pipe was attached to the outlet valve of the tank car, the oil flowing by gravity. Because relatively large-diameter perforations were required to induce this gravity flow, under this method of application a very heavy dosage of oil was applied, sometimes as much as 1,500 gal. to the mile, with the result that the drainage from the ballast was interfered with and ties pumped.

Several years ago we built a machine for spraying oil on the roadbed, in which the oil was first heated in the tank cars in which it is received, by steam from the locomotive. It is then pumped to the delivery pipes where it is heated to a still higher temperature and atomized and sprayed by steam pressure, with the result that only about 350 gal. of oil per mile is used. By this method the oil reaches the roadbed as a fine spray and forms a thin but continuous coating on the ballast, which has a blanketing effect in holding down dust and yet avoids the retention of water around the ties, such as often occurred with the heavy applications of oil made by the earlier methods.

We have found that our present method of applying hot oil has had a considerable effect in killing weeds and that there is also a beneficial effect on ties and track fastenings. There is no permanent effect on the ballast as a result of these applications, since the oil loses its effectiveness with respect to laying dust when the film is broken during track work or through vibration of traffic. For this reason, to be effective, the oil must be applied every year.

With the advent of air-conditioned equipment, the need for oiling to lay dust has diminished. As a result, we now do much less roadbed oiling than formerly, confining our operations largely to spraying the rail and fittings.

May Be Good Investment

By J. G. Hartley
Assistant Engineer, Pennsylvania, Philadelphia, Pa.

Application of oil to the roadbed, by spraying it over ballast composed of gravel, sand or cinders, which contains many fine particles which tend to compact, especially under the binding action of the oil, may be a good investment, because it will prevent the raising of dust when passenger trains are operated at speed over track so treated. The oil tends to mix with the ballast and, by capillary attraction, holds the ballast, particularly the smaller particles, in a compact mass which resists the force of the air currents created by moving trains.

Obviously the oil, which is a by-product of the refining of crude petroleum, and which has a high asphaltic content, will form a coating over ballast of these types. If proper ballast shoulders and side ditches have been provided, the film thus formed will afford quick drainage away from the track, lessening track maintenance.

An original application will, however, be effective only during the year of application. The reason for this is that during the working season some of the oil covering is disturbed, but by spraying the track in successive years the effect of these disturbances is lessened and, as the ballast becomes fairly well impregnated with oil after several seasons, the interval between applications can generally be extended to two or even three years, depending on the volume of traffic and the speed of trains.

Where passenger trains are operated over ballast of the types mentioned, it is quite desirable to spray the roadbed with oil, mainly to provide a clean comfortable ride for passengers. On the other hand, there are several advantages, for the oil destroys most of the vegetation where it is sprayed and eventually results in a compact, better appearing roadbed.

Advantages of Power Saws

What advantages are there in the use of power-driven saws in bridge and building work? For what purposes are they best adapted?

Finds Many Uses

By S. F. Grear
Assistant Engineer of Bridges, Illinois Central, Chicago

Power-driven saws have many advantages in bridge and building work, not the least important being the amount of time that can be saved through their use. The chain-type of cross-cut saw has been used only for cutting off piles. In this application they are very rapid, compared with hand cutting, where conditions permit their use. They are particularly valuable for cutting off foundation piles where there is not much room for manipulating a cross-cut saw by hand. However, in using a power-driven chain saw on piles, care must be exercised to insure that the piles are clean and free from sand or grit, for these substances will ruin the cutting teeth very quickly.

When cutting piles with a chain saw to receive caps, a substantial support or guide must be used to insure square uniform cuts, for this type of saw cuts rapidly with a wide kerf, and must be controlled carefully. Saws of this type have also been used to advantage in cutting out temporary bents when making changes between trains. In such cases, they have a decided advantage over hand methods for, usually, the time element is of high importance.

Bridge gangs use the circular type of power saw to advantage for dapping guard rails and for cutting the ends of ties to line, where this cannot be done before treatment. Our guard rails are dapped to fit over every tie, and on steel spans we have found it best to do the dapping in the field. Obviously, since all possible framing of timbers is done prior to treatment, the use of saws on permanent bridge work is kept to the minimum; yet the circular saw is of value in the construction of temporary trestles in which untreated material is used, in the construction of scaffolds, for other temporary structures and in the construction of concrete forms.

Recently, we built several long leads for pile drivers, these leads consisting of timbers held between two channels. This design required the rebating of the four corners to receive the channels, and this work was done quite easily and cheaply by means of an air-driven circular saw.

In general, building gangs use electrically driven power saws, which are suitable for all kinds of framing. They are especially valuable for making repairs to floors, cutting easily in places where it is difficult to make cuts with hand saws. We have many suburban platforms, 63 in number, aggregating 41,777 lin. ft., or 7.91 miles in length, all laid with transverse planking. Here the power saw has been especially valuable in eliminating the slow laborious work of cutting this planking to line by hand. While these saws have many other uses I have enumerated only a few typical cases to indicate the great saving in time which results from their use.

A Time Saver

By Supervisor of Bridges and Buildings

Portable power saws are adapted for use in almost every project where timber must be cut to size or shape in the construction and maintenance of bridges and buildings. Among the most obvious advantages of this type of equipment are the elimination of what is often slow and burdensome work when done by hand and, as a corollary, the surprising amount of time that can be saved, even on unimportant jobs, through their use, and the advantage of economy that grows out of this time-saving feature.

We have utilized chain saws almost ever since they became available and our gangs would be considerably handicapped if they were compelled to discontinue their use, despite the fact that they are practically limited to cutting off piles and an occasional cut in large dimension timbers. Among the principal advantages of this saw are the rapidity with which it cuts and the elimination of the burdensome and laborious operation of cutting the piles by hand.

More recently, we have been using portable, power-driven circular saws in several sizes and designs. While this equipment is adapted for some of the work of the bridge forces, such as framing scaffolds, constructing concrete forms, framing ties for temporary trestles, etc., it has a much wider application in building construction and maintenance, where it has practically displaced the hand saw, except for minor jobs where it is not practicable to set up the power units. These saws possess the same advantages as the chain saw, in that they result in faster work and less effort, compared with hand sawing.

Are Test Wells Necessary?

Under what conditions are test wells necessary or advisable in the development of underground water supplies? Why? Should they be of the same size as the permanent wells? If not, how can the capacity of the latter be estimated?

They Are Advisable

By J. H. Davidson
Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

Before undertaking the development of well-water supplies involving any considerable expenditure of money, the engineer in charge should have available complete information concerning the various underground conditions to be encountered. It is equally important that he have reliable information concerning the quality and quantity of water available at different depths. If this information cannot be obtained from reliable logs of existing wells in the locality, or if these logs show that the quantity or quality of the water varies between wells within a comparatively limited area, it will be advisable to do some prospecting by means of test wells before locating and drilling the well intended for the permanent supply.

A test well should be of small diameter and preferably drilled with a core drill, so that the various formations encountered may be studied and analyzed more thoroughly. A complete pumping test to determine the yield and draw-down should be made on each vein encountered in which the water is of suitable quality. Study of the results of the test will enable the engineer to determine whether a strainer will be required and, if so, what type will be best. From them he can also determine whether the well should be developed as a gravel pocket or in some other manner.

With the information from the pumping tests assembled, the engineer can calculate the diameter and depth of the permanent well that will be required to furnish the desired quantity and the best quality available. Many formulas have been developed for calculating the probable increase in production of water by increasing the diameter of the well. For instance, King calculates the influence of the diameter of bore of flowing wells as follows:

Assuming the yield of a 2-in. well as 100, the yield of a 6-in. well will be 115.8, and of a 12-in. well 126.7. In pumped wells drilled in sandstone, the maximum yield should be in the same proportions, but the capacity of the pump is the controlling factor, except where the yield is low. For wells in sand and gravel, it is usually safe to assume that doubling the diameter will increase the yield from 15 to 30 per cent under similar conditions.

If the tests indicate that two or more wells will be required to produce the desired quantity of water, considerable care should be exercised to space them properly. Schlicter has calculated the percentage of interference between wells spaced at different intervals. Based on these calculations, two wells spaced 10 ft. apart may be expected to yield about 31 per cent more water than either one alone. If a third well were placed between them, the combined yield of the three would be only about 35 per cent more than for one well alone. If two wells are spaced 200 ft., their combined capacity will be 69 per cent more than that of either of them alone.

Always a Gamble

By Engineer of Water Service

Even under the most favorable conditions the development of a well is somewhat of a gamble. If it is attempted without as complete knowledge of underground conditions as

can be obtained, it is a complete gamble. I recall the instance of a dug well of large diameter that was sunk to a considerable depth adjacent to an extensive swamp on the supposition that there was an abundance of ground water. To insure against the caving of the saturated strata, a cutting ring was provided and the brick lining was kept built up to the surface of the ground as the ring was forced down. Ample pumping equipment had also been provided to keep the water pumped down during construction, but at a depth of about 60 ft. the hole was abandoned because no water had been encountered, the strata scarcely being damp.

Many states have gathered data on the availability of underground waters and concerning geological formations, and these should be studied. This information should be supplemented by an investigation of other wells in the vicinity with respect to the yield and quality of the water they produce. If the logs of these wells are available, they will be of considerable help. After this information has been digested, one or more test wells of small diameter should be sunk until a satisfactory source is reached. In doing this, particular attention should be given to the strata encountered, especially those bearing water. The water should be sampled for quality and a pumping test made for yield at every water-bearing point until a satisfactory source is found.

For shallow wells several test holes can be put down at small cost. In the case cited, a 2-in. test hole would have cost less than the cutting ring and the remainder of the expense would have been avoided. For deep wells, a 2-in. test hole with a core drill will afford an opportunity to study the several strata dependably. Among the important facts to ascertain, aside from the quality of the water, are the water table, the thickness and nature of the water-bearing formation and the character of the strata above and below, as these may affect the yield of the well.

A pumping test is important, but it should not be overlooked that a test hole is seldom finished in such a manner that its yield is comparable to that of a finished well. However, numerous formulas have been educed from which an intelligent estimate can be made of the probable yield of the finished well, these formulas generally being based on relative diameters.

What Method of Tamping?

What are the relative advantages of tamping ties with shovels, with tamping bars or tamping picks and with tie tampers? The disadvantages? Does the kind of ballast make any difference?

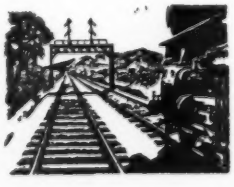
Depends on Ballast

By I. H. Schram
Engineer Maintenance of Way, Erie, Jersey City, N.J.

Both the kind of ballast and the amount the track is being lifted make a vital difference in the kind of tool to be used for tamping ties. In high-speed track ballasted with stone, such as is used generally in the eastern part of the United States, equipment adapted for such ballast has been developed. It is our experience, however, that it is not economical or advisable to use it in all other kinds of ballast or for all kinds of work. Power tie tampers are highly desirable for tamping out of face in hard ballast, which includes stone, prepared slag and the better grades of gravel having a considerable content of crushed stone. In no other way can ballast be compacted sufficiently under the tie and uniformly for all ties. Various forms of hand tamping give differing degrees of compactness to the ballast, resulting in irregular and poor-riding track.

There are several designs of tie tampers. The pneumatic type was the earliest and first fully successful type, and its use has been standardized to such an extent that the time and best shape of tool required for tamping each kind of hard ballast has been developed and in this form of ballast it is probable that the most uniform results are obtained with it.

For spot tamping or for tamping ties that have been dug in, the tamping pick is probably the best tool. Used by experienced men, it does the most effective tamping and can be so manipulated that adjacent ties are not loosened by overtamping, something that is almost impossible to prevent when power tampers are used for spot tamping. Tamping bars are useful in some tight places where power tampers cannot be used effectively, as around slip switches, crossings, etc. However, the men using these tools require close supervision to insure effective work.



A shovel is the best tool for soft ballast, such as cinders, bank gravel, fine slag, etc., for the tamping can be done rapidly with no danger of damaging the ballast. It is my experience that it is not economical or desirable to use power equipment in such ballast.

For high lifts, where settlement is to be expected, and where hard ballast is being used, the tamping fork is particularly effective. Ballast can be shoved under the ties faster with this tool than with any other, and can be placed with sufficient uniformity to hold the track in good surface until it is compacted and settled by traffic. After this is accomplished the track can be given a light lift and tamped with power tampers.

Ballast Determines

By E. L. Banion
Roadmaster, Atchison, Topeka & Santa Fe, Marceline, Mo.

In general, the kind of ballast determines the method of tamping and the tools to be used. Shovels are best adapted for chatts, screenings, cinders, fine gravel, sand, disintegrated granite or any other of the so-called fine ballast materials. Tamping bars and tamping picks are for coarser material, crushed stone, gravel, slag, etc., ranging from 1 to 2½ in. in size, the bars being adapted particularly for tamping in close quarters, that is, around switches, crossings, etc. Power tampers are suitable for almost any class of ballast, where large gangs are employed for out-of-face surfacing. On certain multiple-track lines the compact, light-weight, off-track designs are advantageous for small gangs.

Shovel tamping has the advantage of being a quick, economical method of raising track. Bar and pick tamping are adapted particularly for solid tamping in coarse ballast by small gangs. Shovel and fork tamping are seldom desirable in coarse ballast, except for high raises.

Machine tamping is superior where large forces are employed, because of the greater uniformity and better quality of the tamping. Tie tampers do less damage to the ties than other tools, except shovels.

What Our Readers Think

Elevating Curves for Low Speed

Halifax, N. S.

To the Editor:

I desire to comment on the subject of elevating curves on low-speed tracks, which was discussed on page 40 of the January issue. Pressure of the flanges of the wheels against the outside rail on curves is caused (1) by the centrifugal force resulting from speed and (2) by the resistance of the wheels against being turned from a straight path, the latter always being present when cars or locomotives are moving around curves, but independent of the speed. It is impossible by any known arrangement to prevent flange pressure against the outer rail on curves. At low speeds, the centrifugal force is insignificant even on sharp curves, and the resulting flange pressure is so small a part of the total that it may be ignored.

At slow speed on sharp curves any elevation of the outer rail decreases the weight imposed on the wheels running on that rail, and thus increases the tendency of the flanges to climb over the rail and cause derailment. At the same time the weight on the inner wheels is increased correspondingly, thus increasing the resistance of these wheels to the lateral sliding necessary to aline the trucks, as well as to the slip required to compensate for the shorter travel on the inner rail. This tends to increase the flange pressure against the outer rail and the probability of derailment.

Flange pressure against the rail tends to spread track, overturn the rail and throw the track out of line. Spreading may be resisted by means of gage rods and overturning by the application of rail braces. In paved streets the track is held in line by the pavement. In ballasted track, it may be necessary in extreme cases, to place second-hand bridge timbers against the outer ends of the ties, so that each timber will engage two ties and thus aid in distributing the thrust of the ties against the ballast shoulder.

Oiling the flanges of the wheels in contact with the outer rail will decrease the tendency to climb the rail. In extreme cases where it does not interfere with traction, it may be necessary to oil the running surface of the inner rail to reduce the resistance to slip and lateral sliding.

For curvature up to 20 deg. on restricted approaches to wharves, and with the increased length and weight of switch engines, any elevation of the outer rail invariably results in derailment. These tracks are installed with the rails level or even with some elevation on the inner rail. This practice results in the elimination of derailments and lessens flange wear. The inside rail of 12-deg. curves on wye tracks has been given as much as ¾ in. of elevation with good results.

L. H. Robinson,
Division Engineer,
Canadian National.

New Books

Roadmasters' Proceedings

PROCEEDINGS of the Roadmasters' and Maintenance of Way Association of America for 1938, 149 pages, 6½ in. by 9¾ in., bound in cloth. Published by the Association, 319 North Waller avenue, Chicago. Price $2.

The feature of this volume, which follows in general appearance and pattern the Proceedings of previous years, is the reports and addresses, with subsequent discussion, presented before the Fifty-Third annual convention of the association in Chicago on September 20-22, 1938. The reports contained in the volume have to do with the following subjects:

Materials and Equipment for the Section Gang of Today; Maintenance of Line and Surface to Meet Present-Day Operating Requirements; Methods of Instructing Track Men in Safety; Elimination of Train Derailments Resulting from Track Defects; Programming of Track Work; and Maintenance of Turnouts. The papers and addresses deal with Using Track Labor Efficiently, by F. S. Schwinn, assistant chief engineer, Missouri Pacific; The Roadmaster's Job, by F. G. Gurley, at the time assistant vice president, Chicago, Burlington & Quincy and now vice-president of the Atchison, Topeka & Santa Fe; Better Track Construction for Tomorrow's Traffic, by F. R. Layng, chief engineer, Bessemer & Lake Erie; and American verus English Maintenance of Way Practices, by W. K. Wallace, chief engineer, London, Midland & Scottish railway of England. In addition, the Proceedings presents the transactions of the opening exercises and business section of the convention; a stenographic report of the Question-Box session included in the convention program, which dealt with 14 questions of specific interest to maintenance of way supervisory officers; and the usual lists of members, registration at the convention, and members of the Track Supply Association which exhiibted in conjunction with the convention.

Bridge and Building Proceedings

PROCEEDINGS of the American Railway Bridge and Building Association, forty-fifth annual convention. 208 pages, illustrated, 6 in. by 9 in. Bound in cloth. Published by the association, C. A. Lichty, secretary, 319 North Waller avenue, Chicago. Price $2.

Similar in style and make-up to preceding annual volumes of the Proceedings of this association, the present volume covers the activities of the association during 1938, as reported upon at its forty-fifth annual convention in Chicago on October 18-20, 1938.

The feature of the Proceedings is the reprinted reports and papers presented at the convention, along with the discussion which took place from the floor. The reports, prepared and presented by committees, have to do with the maintenance of cinder pits; the possibilities and limitations of the acetylene cutting torch; field methods in the construction of timber trestles; pipe lines for railway water service; meeting today's demands with cranes and pile drivers; the inspection and preparation of wood surfaces for painting; the maintenance of movable bridges; and the insulation of railway buildings. The papers reprinted are on Safety in These Days of Reduced Forces, by John E. Long, superintendent of safety, Delaware & Hudson; Lessons to Be Learned from Recent Bridge Failures, by R. A. Van Ness, bridge engineer, Atchison, Topeka & Santa Fe; and Current Trends in the Design of Railway Buildings, by L. P. Kimball, engineer of buildings, Baltimore & Ohio. Other sections are given over to a report of the business sessions of the convention, a directory of membership, and to addresses by A. N. Williams, president of the Chicago & Western Indiana and the Belt Railway Company of Chicago, and by Samuel H. Cady, vice-president and general counsel, Chicago & North Western.

NEWS of the Month

Santa Fe Section Forces Help Fight Grasshoppers

Santa Fe section foremen in certain areas in the Southwest have been instructed in the method of mixing and spreading grasshopper poison and are now engaged in efforts to clear the railroad right-of-way of these insects in a railroad program co-operating with state and county agents, designed to destroy the insects before they have a chance to migrate. A recent survey shows that many areas in the southwestern states are thickly infested with grasshopper eggs.

Union Pacific Honored in Golden Spike Celebration

In a celebration extending from April 26 through April 29, which included parades, pageants, an Indian encampment, huge banquets and the first meeting of the board of directors of the U. P. ever held outside of New York, the entire city of Omaha and nearly 200,000 visitors joined in a colorful ceremony to commemorate the driving of the Golden Spike on May 10, 1869, at Promontory, Utah, which completed the linking of the Atlantic and the Pacific by rail, seventy years ago.

6000-Mile Rail-Fan Tour

A Golden Gate Rail-Fan Tour reaching Los Angeles, Cal., San Francisco and Denver, Colo., and including not only the usual scenic tours but also inspections of railroad facilities along the way and an all-day trip on the Denver & Rio Grande Western's narrow gage line crossing Marshall Pass, will be operated over the tracks of the Santa Fe, the Western Pacific, the D. & R. G. W., the Missouri Pacific and the Milwaukee, leaving Chicago August 6 and returning on August 20. The tour is sponsored by the Railroad Magazine and the Chicago chapter of Railway Locomotive Historical Society, Inc.

Eastman Criticizes Full Crew Laws

In a concurring opinion written in the case of an abandonment by the Chicago, Milwaukee, St. Paul & Pacific, Interstate Commerce Commissioner Joseph B. Eastman strongly criticized state "full crew" laws and agreements between railroads and labor organiaztions which require the employment of unnecessary labor in railroad operations. He indicated that such laws frequently make the operation of branch line trains unprofitable and eventually result in abandonment, with the result that the laws, instead of making work for more men, actually cause an eventual reduction in jobs.

Meyer Says Equality of Competition Necessary

In an address before the Western Railway Club at Chicago on May 22, Balthasar H. Meyer, who retired on May 1 as a member of the Interstate Commerce Commission, stated that "Compared with the decisive factor of equality in competition" all other factors of the transportation problem are "distinctly secondary" —"this is United States transportation problem No. 1." Transportation problem No. 2 "is the relation of the private carriers to the common carriers." "The law of the survival of the fittest should be permitted to operate," he said, "provided the struggle takes place on a basis of substantial equality." In connection with problem No. 2 Mr. Meyer pointed out that although the railroads cannot engage in business because of the unfair advantages that might be gained, business is not restricted from entering the transportation field with its own fleets of trucks or barges and thus obtain advantages over smaller competitors. He stated that the government cannot side-step problem No. 1 and predicted that in the near future the problem of the common carriers vs. private carriers would be the nation's paramount transportation problem.

Railroad Exhibits at New York World's Fair

The railroad building, largest at the New York World's Fair, which was built by the member roads of the Eastern Presidents' Conference, houses some of the outstanding exhibits of the fair and its contents are valued at between three and five million dollars. The main entrance to the building is designed with a large three-tiered dome which symbolizes the form of a roundhouse. Under this dome is the joint exhibit of the railway supply companies, erected and maintained from funds contributed by more than 630 companies. The feature of this exhibit is an animated cyclorama in the form of a huge artificial mountain 28 ft. high and 80 ft. in diameter at the base. On this mountain, by means of actual working models, all built on a scale of ¼ in. equals one ft., the story of the building of a railroad, complete with equipment, and the interrelation of all the processes of raw-material extraction and manufacture connected with this process is portrayed by miniature layouts.

In another section of the railroad building is an exhibit entitled Railroads at Work, which is presented by the 27 Eastern railroads comprising the membership of the Eastern Presidents' Conference. This exhibit consists of an auditorium containing a diorama measuring 7,000 sq. ft. in area and a grandstand which will seat 1,000 persons. The diorama depicts on a small scale in half an hour the 24-hr. real-life drama which the railroads enact daily, with working models of miniature trains of all classes, operating in and out of a model city and through a terrain embodying in miniature the typical topographical features found along main lines in the Eastern states and representing in scale an area of 50 sq. mi. with approximately 40 miles of railroad track.

Next to the Railroads at Work exhibit and occupying a place of honor, is the new four-cylinder 6-4-4-6 locomotive built in the Pennsylvania's shops at Altoona, Pa. and described briefly in the April issue of *Railway Engineering and Maintenance*. In addition to these exhibits, there are many interesting individual exhibits of the railroads and the railroad supply companies.

Plan to Split M. & St. L.

A plan to divide the Minneapolis & St. Louis, which has been in receivership since July, 1923, has been filed with the Interstate Commerce Commission by W. W. Colpitts of Coverdale & Colpitts, New York, reorganization managers of the road. Briefly the plan would provide for the formation of two new companies, the Minneapolis & St. Louis **Railway Company,** which would operate the more prosperous main lines, and the Minneapolis & St. Louis **Railroad Corporation,** which would operate the light traffic lines west of Tara, Iowa and Winthrop, Minn. All of the capital stock of the latter company would be owned by the former, but their operations would be separate and distinct. The reorganization would be accomplished with the aid of a $5,000,000 loan to the new companies by the Reconstruction Finance Corporation.

Association News

Metropolitan Maintenance of Way Club

The annual outing of the club will be held at the Houvenkopf Country Club, Suffern, N. Y., on June 29. As in past years the program for the day will include golf and other out-door sports, and a luncheon at noon.

Roadmasters Association

President F. B. La Fleur has called a meeting of the Executive committee and chairmen of the standing committees at Chicago on June 17, to consider the reports to be presented at the annual convention, September 19-21, and to transact other business as may require attention.

Railway Tie Association

Approximately 60 producers of railway crossties and railway officers interested in their use met in the twenty-first annual meeting of the Railway Tie Association in Cincinnati, Ohio, on May 23. At the conclusion of this meeting, which was limited to the consideration of reports of eight committees, the following officers were elected: President, Walter Firmin, manager, Wyoming Tie & Timber Company, Metropolis, Ill.; first vice-president, Leonard Perez, district manager, Wood Preserving Corporation, St. Louis, Mo.; second vice-president, H. C. Woolf, president, Bond-Woolf & Company, Alcoa, Tenn.; directors, Meyer Levy, vice-president, J. T. Moss Tie Company, St. Louis, Mo.; T. J. Turley, Bond Brothers, Louisville, Ky.; D. W. Bower, Potosi Tie & Lumber Company, St. Louis, Mo.; R. H. Johnson, B. Johnson & Son, Richmond, Ind.; and R. H. White, president, Southern Wood Preserving Company, Atlanta, Ga.

American Railway Engineering Association

Five committees of the association have already scheduled meetings for June as follows: Water Service, Fire Protection and Sanitation, at Atlantic City, N. J., on June 13; Roadway and Ballast, at New York, on June 15 and 16; Economics of Railway Location and Operation, at Richmond, Va., on June 15 and 16; Yards and Terminals, at Rochester, N. Y., on June 27 and Buildings, at New York, on June 27 and 28. Five committees met during May, including Iron and Steel Structures, at Columbus, Ohio, on May 4 and 5; Economics of Railway Labor, at Omaha, Neb., on May 4, 5 and 6; Track, at Chicago, on May 17; Rail, at New York, on May 25; and Waterways and Harbors, at Chicago, on May 25.

The 1939 Proceedings, reporting the activities of the convention last March, are now in the hands of the printer and it is expected that this volume will be made available to members late in June.

The booklet on Outline of Work and Personnel of Committees, that has been mailed to committee members, shows that 39 new subjects have been assigned to 14 of the association's 27 standing and special committees. The list below gives the new subjects assigned each committee.

Roadway and Ballast—Prevention of erosion in natural waterways; roadway slope protection against slides and rock falls; roadway retaining structures; tunnel lighting; design of roadway signs; specifications and plans for telltales; the effect of locomotive blow-off on track maintenance.

Ties—Cause and control of the splitting of railroad ties.

Rail—Investigate joint bar failures and give consideration to the revision of design and specifications.

Track—Specifications for laying rails, designed to set up requirements for good workmanship; methods of shimming track; spirals for high-speed operation.

Buildings—Railroad warehouse requirements for the handling of quick-frozen products; methods of determining the protective and economic value of paints; refrigerator equipment for cold storage houses and rooms.

Wood Bridges and Trestles—Specifications for the design of wood bridges and trestles.

Masonry—Bibliography and review of current engineering literature pertaining to railroad masonry work; pressure grouting; specifications for concrete and reinforced concrete railroad bridges and other structures; specifications for test borings.

Highways—Requisites for flexible barrier type of grade crossing protection; the Striping of crossing gates.

Water Service, Fire Protection and Sanitation—New types of pipe and their application to railroad water service; methods for rejuvenating deep wells; fire extinguishers; the use and application of chemicals for preventing deposits in pipe lines.

Economics of Railway Location and Operation—Effect of highway transportation on the economics of railway operation.

Wood Preservation—Revision of specifications for the treatment of Douglas fir.

Uniform General Contract Forms—Form of agreement for electrified fence along the right-of-way; form of blanket agreement for wire line crossings.

Economics of Railway Labor—Review and revise factors previously established for equating track values for labor distribution; labor economies possible through the use of highway motor vehicles for maintenance forces; added labor economies resulting from the use of off-track maintenance equipment; labor economies which may be effected through revision of operating and maintenance of way and structures rules; economies in labor resulting from the reduction in track patrol made possible through improvements in track conditions.

Maintenance of Way Work Equipment—Lubrication of roadway machines; off-track ditchers; rail loaders and unloaders.

Personal Mention

General

H. T. Livingston, district maintenance engineer of the Chicago, Rock Island & Pacific, with headquarters at El Reno, Okla., has been promoted to superintendent of the Arkansas division, with headquarters at Little Rock, Ark.

B. O. Fryer, roadmaster of the Expanse subdivision of the Canadian Pacific, with headquarters at Moose Jaw, Sask., has been promoted to assistant superintendent and roadmaster of the Prince Albert Terminal and the Meadow Lake, Medstead and Whitkow subdivisions, with headquarters at Prince Albert, Sask.

C. L. Persons, assistant chief engineer of the Chicago, Burlington & Quincy lines East of the Missouri river, has been promoted to assistant to the executive vice-president of the Burlington Lines, including the Colorado & Southern, the Fort Worth & Denver City and the Wichita Valley, with headquarters as before at Chicago, succeeding to the duties of **John W. Wheeler,** assistant engineer, who resigned on May 11, to take charge of contracting work for the Cities Construction Company, Hammond, Ind.

C. L. Persons

Mr. Persons was born at Wadsworth, Ill., on August 4, 1872, and entered railway service in the engineering corps of the Burlington in 1904 as a topographer, later serving in various capacities on construction and maintenance work. In 1908, he was promoted to locating engineer, Lines East, with headquarters at Chicago, and in 1916, he was appointed assistant engineer, assigned to special work, on the chief engineer's staff. Mr. Persons was advanced to assistant chief engineer of lines East of the Missouri river in 1918.

Ernest L. Potarf, district engineer maintenance of way of the Chicago, Burlington & Quincy, with headquarters at Omaha, Neb., has been promoted to assistant superintendent of the Alliance-Sterling division, with headquarters at Sterling, Colo. Mr. Potarf was born at Portland, Ore., on November 28, 1897, and

entered railway service in April, 1916, on the Burlington, as an axeman on construction. The following year he was promoted to rodman at Sheridan, Wyo., and in September, 1918, he was advanced to instrumentman on the Wyoming district. Mr. Potarf was promoted to division engineer of that district in December, 1919, and on January 7, 1933, he was advanced to assistant engineer in the chief engineer's office in Chicago. On August 16, 1934, he was appointed district engineer of maintenance of way at Omaha.

Ernest L. Potarf

C. D. Merrill, an engineer by training and experience, whose promotion to superintendent of stations and transfers of the Eastern region of the Pennsylvania, with headquarters at Philadelphia, Pa., was announced in the May issue, was born at Sullivan, Ind., on July 12, 1901, and graduated from Purdue University. He entered railway service on March 14, 1925, as an assistant in the engineering corps and was appointed assistant supervisor of the Fort Wayne division on August 16, 1928. On January 5, 1931, he was promoted to supervisor, with headquarters at Wilkes-Barre, Pa., and on July 24, 1933, he was transferred to West Philadelphia, Pa. Mr. Merrill was assigned to the office of the vice-president in charge of traffic as division engineer on November, 16, 1935, and on January 1, 1935, he was transferred to the office of the chief engineer at Philadelphia as division engineer on special duty. He was promoted to superintendent of the Wilkes-Barre division on February 1, 1937.

C. D. Merrill

Effective June 1, the following men, all engineers by training and experience, have been promoted on the Chicago, Burlington & Quincy. **H. C. Murphy,** assistant to the executive vice-president, with headquarters at Chicago, has been promoted to assistant vice-president, with the same headquarters. **E. H. Piper,** division superintendent, with headquarters at Centerville, Iowa, has been advanced to assistant to the executive vice-president replacing Mr. Murphy. **W. O. Frame,** assistant superintendent at Wymore, Neb., has been promoted to superintendent at Centerville, relieving Mr. Piper, and **R. L. Sims,** whose transfer to Omaha, Neb., on May 16, as district engineer maintenance of way, is announced elsewhere in these columns, has been advanced to assistant superintendent at Wymore.

R. W. Sheffer, whose promotion to superintendent of the Wilkes-Barre division of the Pennsylvania, with headquarters at Sunbury, Pa., was announced in the May issue of *Railway Engineering and Maintenance,* was born at York, Pa., on August 9, 1902, and graduated in civil engineering from Bucknell University. He entered railway service on August 1, 1923, as a rodman on the Pennsylvania and on November 17, 1926, he was appointed assistant supervisor of the Delaware division, serving later in the same capacity on the New York, the Middle and the Philadelphia Terminal divisions. On November 10, 1928, Mr. Sheffer was appointed supervisor on the Sunbury division and was transferred to the Atlantic division in 1929, to the Philadelphia Terminal division in 1930, and to the Panhandle division in July, 1933. He was promoted to division engineer in the chief engineer's office at Philadelphia on October 5, 1934, and on June 1, 1935, he was transferred to the department of the vice-president in charge of traffic as division engineer, special duty. On November 19, 1935, Mr. Sheffer was transferred to the Middle division as division engineer and on August 9, 1937, he was transferred to the Pittsburgh division.

R. W. Sheffer

J. E. Crawford, vice-president in charge of operation of the Norfolk & Western, with headquarters at Roanoke, Va., and an engineer by training and experience, has been appointed vice-president—assistant to president. **R. H. Smith,** general manager, and also an engineer by training and experience, has been appointed vice-president and general manager in charge of the operating department, with headquarters at Roanoke. Mr. Crawford was born in San Diego, Cal., on December 1, 1876, and was educated at the University of Pennsylvania. He entered the service of the Pencoyd Iron Works in 1895 as a draftsman and was later promoted to designer in the same organization. In July, 1903, Mr. Crawford entered the service of the Norfolk & Western as bridge engineer, remaining in that capacity until May, 1913, when he was promoted to chief engineer. He was appointed assistant general manager in February, 1923, and in the following year became general manager. He was appointed vice-president in charge of operation on December 1, 1936, the position he has held since.

J. E. Crawford

Mr. Smith was born in Baltimore, Md., on March 10, 1888, and graduated in civil engineering from Princeton University in 1911. He entered the service of the Norfolk & Western on July 1, 1910, as an axeman in the engineering department at Roanoke, during a summer vacation while attending college. He re-entered the service of the N. & W., in June of the following year as a masonry inspector in the same department and on February 1, 1912,

R. H. Smith

was appointed transitman. On June 1, 1913, he was promoted to assistant roadmaster of the Radford division at Pulaski, Va., and Roanoke. On October 15, 1914, Mr. Smith was advanced to roadmaster of the same division and in June, 1917, he was appointed assistant superintendent of the Pocahontas division. In October, 1919, he was transferred to the Radford division, being promoted to the position of superintendent of the Radford division on December 26, 1922. Mr. Smith became general superintendent of the Eastern General division in 1931, and subsequently became general superintendent of the Western General division. He was appointed general manager in 1936.

Paul E. Feucht, superintendent of passenger transportation on the Pennsylvania, Eastern Region, with headquarters at Philadelphia, Pa., and an engineer by training and experience, has been promoted to general superintendent, of the Southwestern division with headquarters at Indianapolis, Ind. Mr. Feucht was born at Indianapolis, Ind., on January 4, 1900, and completed his college education

Paul E. Feucht

at Purdue University. He entered the service of the Pennsylvania on March 1, 1923, as an assistant on the engineering corps of the Louisville division and in May, 1925, he was transferred to the Indianapolis division. In January, 1927, he was promoted to assistant track supervisor and assigned to the Philadelphia Terminal division, and in September, 1928, he was transferred to Tyrone, Pa. Mr. Feucht was advanced to supervisor at Norristown, Pa., in January, 1929, and a year later he was transferred to the main line at Tyrone. For a few months in 1933, he was relieved of his track work and assigned to special duty in the motor service and upon the completion of this work in July, 1933, he was promoted to division engineer of the Renovo division. In October, 1934, he was transferred to the Fort Wayne division. Mr. Feucht was advanced to superintendent of the Wilkes-Barre division on April 1, 1935, and on May 1, 1936, he was appointed superintendent of passenger transportation of the Eastern region.

J. W. Neikirk, whose promotion to assistant superintendent of the Norfolk & Western, with headquarters at Portsmouth, Ohio, was announced in the May issue, was born in Smyth County, Va., on February 18, 1902, and entered railway service as a section laborer on the Radford division of the N. & W. on October 1, 1918. He was later promoted successively to relief foreman, assistant extra gang foreman, section foreman, rail gang foreman and assistant roadmaster on the Pulaski division. Mr. Neikirk was later transferred to the Radford division and in March, 1938, he was promoted to roadmaster on that division, with headquarters at Roanoke, Va., the position he held at the time of his recent promotion.

Engineering

P. M. Stutrud, office engineer of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., has been promoted to assistant chief engineer, with the same headquarters, a newly created position.

W. H. Lowther, assistant engineer on the Union Pacific at Ketchum, Idaho, has been promoted to division engineer, with headquarters at Spokane, Wash., succeeding **E. F. Kidder,** who has been appointed assistant engineer at Ketchum.

A. J. Gayfer, assistant division engineer on the Canadian National, with headquarters at Edmonton, Alta., has been promoted to division engineer, with headquarters at Calgary, Alta., succeeding **W. Fetherstonhaugh,** who retired on April 14.

R. H. Carter, acting division engineer on the Illinois Central, with headquarters at Chicago, has been promoted to division engineer at that point, succeeding **J. J. Desmond,** who has been assigned to other duties, with headquarters at Water Valley, Miss.

G. A. Williams, main line supervisor in the office of the vice-president in charge of traffic of the Pennsylvania, at Philadelphia, Pa., has been appointed division engineer of the Conemaugh division, with headquarters at Pittsburgh, Pa., succeeding **B. W. Tyler,** who has been appointed engineer of the Washington Terminal at Washington, D. C.

T. M. Pajari, office engineer on the Chicago, Milwaukee, St. Paul & Pacific at Seattle, Wash., has been promoted to division engineer, with headquarters at Terre Haute, Ind., succeeding **W. Lakoski,** who has been transferred to the Iowa and Dakota division, with headquarters at Mason City, Iowa, relieving **C. H. Tusler.**

W. A. Gunderson, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Pratt, Kans., has been promoted to district maintenance engineer, with headquarters at Kansas City, Mo., succeeding **Mason W. Rector,** who has been transferred to El Reno, Okla., replacing **H. T. Livingston,** whose promotion to superintendent, with headquarters at Little Rock, Ark., is announced elsewhere in these columns.

F. H. McKenney, who has been in charge of the rail detector car of the Chicago, Burlington & Quincy, has been promoted to district engineer maintenance of way of the Lines West of the Missouri river, with headquarters at Omaha, Neb., succeeding **R. L. Sims,** whose promotion to assistant superintendent at Wymore, Neb., is announced elsewhere in these columns.

C. S. Weatherill, whose promotion to chief engineer of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., was announced in the April issue, was born at Newburg, Minn., on August 26, 1891, and graduated in civil engineering from the University of Minnesota in 1915. Mr. Weatherill entered the service of the M. & St. L. in April, 1916, as an instrumentman and in January, 1917, he was promoted to assistant engineer. Ten years later he was advanced to supervisor of track, with headquarters at Estherville, Iowa, and on November 1, 1929, he was promoted to supervisor of bridges and buildings, with headquarters at Ft. Dodge, Iowa. In June, 1933, he was appointed supervisor of track, with headquarters at Oskaloosa, Iowa, and in November of that year he was promoted to supervisor of bridges and buildings of the Eastern divi-

C. S. Weatherill

sion, with the same headquarters. On October 1, 1936, Mr. Weatherill was advanced to division engineer, with headquarters as before at Oskaloosa, and on January 16, 1937, he was promoted to engineer maintenance of way, with headquarters at Minneapolis.

P. W. Triplett, whose promotion to division engineer of the Renovo division of the Pennsylvania, with headquarters at Erie, Pa., was announced in the May issue, was born on May 14, 1904, at Elkins, W. Va., and received his higher education at the University of Maryland. He entered railway service with the Pennsylvania on June 25, 1927, as an assistant on the engineering corps of the Baltimore division, later being transferred to the New York division. On November 8, 1928, he was appointed assistant supervisor of track, in which capacity he served on the Middle and Philadelphia divisions until August 1, 1929, when he was advanced to supervisor of track, holding this position successively on the Cresson, Sunbury, Maryland, Atlantic and Chicago Terminal divisions. On March 1, 1938, he was further promoted to assistant division engineer of the New York division, with headquarters at Jersey City, N. J., hold-

ing this position until his recent promotion to division engineer.

Thomas Jason Engle, estimator in the chief engineer's office of the Chicago, Rock Island & Pacific at Chicago, has been promoted to assistant engineer of buildings, with the same headquarters, succeeding **T. D. Frederick,** who resigned in October, 1938.

Gustave A. Haggander, bridge engineer of the Burlington Lines, with headquarters at Chicago, has been promoted to assistant chief engineer of the Lines East of the Missouri river, with the same headquarters, succeeding **C. L. Persons,** whose promotion to assistant to the executive vice-president is announced elsewhere in these columns and **Richard W. Willis,** assistant engineer at Chicago, has been advanced to principal assistant engineer, with the same headquarters. **Frank H. Cramer,** assistant bridge engineer at Chicago, has been promoted to bridge engineer, replacing Mr. Haggander and **M. L. Johnson,** office engineer to the assistant bridge engineer at Chicago, has been advanced to assistant bridge engineer, relieving Mr. Cramer. **R. L. Sims,** district engineer maintenance of way, with headquarters at Galesburg, Ill., has been transferred to Omaha, Neb., succeeding **Ernest L. Potarf,** whose promotion to assistant superintendent is announced elsewhere in these columns and **Elzear J. Brown,** roadmaster, with headquarters at Chicago, has been advanced to district engineer of maintenance of way at Galesburg, replacing Mr. Sims.

Gustave A. Haggander

Mr. Haggander was born at Sioux City, Iowa, on January 30, 1885, and graduated from Armour Institute of Technology, Chicago. He entered railway service in 1905 as a draftsman in the office of the bridge engineer of the Burlington, later serving as a concrete inspector and a designer. On June 10, 1910, he was promoted to office engineer and two years later he was advanced to assistant bridge engineer of the lines East of the Missouri river, with headquarters at Chicago. Mr. Haggander was promoted to bridge engineer of the Burlington system in 1916, with headquarters as before at Chicago, and in December, 1938, his jurisdiction was extended over the Burlington Lines to include the Colorado & Southern and the Fort Worth & Denver City.

Mr. Willis was born at Charlestown, W. Va., on July 27, 1874, and graduated from Virginia Military Institute in 1895.

Richard W. Willis

He entered railway service on April 18, 1896, as a rodman on the Lake Shore & Michigan Southern (now a part of the New York Central), resigning the following year to engage in real estate business. He re-entered railway service on April 8, 1898, as a rodman on the Burlington and on August 1, 1902, he went with the Cincinnati Northern (now part of the New York Central) as assistant to the chief engineer. Mr. Willis returned to the Burlington in April, 1903, as an assistant engineer on construction work, and on January 1, 1905, he was promoted to division engineer at Galesburg. Two years later he was advanced to district engineer, with headquarters at St. Louis, Mo., and on February 1, 1914, he was transferred to Chicago. He was later appointed division engineer of the Galesburg and Beardstown divisions, with headquarters at Galesburg and in the summer of 1936 he was promoted to assistant engineer, with headquarters at Chicago, the position he held at the time of his recent promotion.

Mr. Cramer was born in Chicago on July 24, 1883, and attended the Chicago School of Engineering for two years and the Lewis Institute for five years. He entered railway service in January, 1904, as a draftsman on the Burlington in Chicago. In June, 1907, he was promoted to inspector and in May, 1912, to designer. He later served as acting chief designer and in April, 1913, he was advanced to office engineer. Mr. Cramer was promoted to assistant bridge engineer in April, 1919, holding that position until his recent promotion.

Frank H. Cramer

J. C. Aker, assistant engineer of the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn., has been promoted to assistant chief engineer, with the same headquarters, a newly created position.

W. T. Covert, chief engineer of maintenance of way of the Eastern region of the Pennsylvania, with headquarters at Philadelphia, Pa., has been promoted to assistant chief engineer of the system, with the same headquarters, a newly created position, and **Henry H. Garrigues,** general superintendent of the Central Pennsylvania division, with headquarters at Williamsport, Pa., has been promoted to chief engineer of maintenance of way of the Eastern region, succeeding Mr. Covert. Mr. Covert was born on January 4, 1873, at Philadelphia, Pa. He was graduated from the Pierce School of Business, Philadelphia, and from Cooper Institute, New York. He entered railway service in May 1890, as a clerk in the accounting department of the Pennsylvania at Philadelphia and until October 3, 1895, was a rodman on that road and served in various capacities in connection with construction work under the engineer maintenance of way of the United Railroads of New Jersey. From the latter date until June, 1897, he was in the office of the principal assistant engineer of the Pennsylvania at Altoona, Pa. He then became assistant supervisor of the Philadelphia division at Paoli, which position he held until July, 1900, serving successively from that date until October 25, 1917, as supervisor on the Renovo division, supervisor in the Philadelphia yards, assistant engineer on the Chautauqua division, assistant engineer on the Eastern and Susquehanna division and division engineer on the Philadelphia Terminal division. On October 25, 1917, Mr. Covert was appointed principal assistant engineer of the Western Pennsylvania division at Pittsburgh, Pa., and on March 1, 1920, he became engineer maintenance of way of the Western Pennsylvania division, with headquarters at Pittsburgh, Pa. He was appointed chief engineer, maintenance of way, of the Eastern region on June 1, 1926, the position he held until his recent appointment as assistant chief engineer of the system.

Mr. Garrigues was born on September 4, 1881, at Harrisburg, Pa. He was educated at Haverford School and Haverford College, and entered the service of the Pennsylvania on February 18, 1901, on the Belvidere division at Lambertville, N. J. On March 21, 1903, he was transferred to the Philadelphia division as a rodman and on September 2 of the same year he went to Altoona, Pa., as a transitman. He was assistant supervisor at Altoona, Pitcairn, Pa., and Perryville, Md., from January, 1904, to December 1, 1908. On the latter date he became supervisor at Kittanning, Pa., and from 1912 to 1914 served as supervisor of the West Jersey & Sea-

shore and in the office of the general manager. On January 1, 1915, he was appointed pilot engineer at Philadelphia and during 1917 was supervisor on the Baltimore and Philadelphia divisions, becoming acting division engineer in December, 1917. In May, 1918, Mr. Garrigues became division engineer of the Trenton division and was transferred to the Philadelphia Terminal division in 1919, becoming engineer of maintenance of way of the Southern division in March, 1920. Two months later he was appointed superintendent of the Delaware division, and was later transferred to the Atlantic and Camden Terminal Divisions, the Philadelphia and Camden Ferry, and the Philadelphia Terminal division. Mr. Garrigues was promoted to general superintendent of the Illinois division at Chicago on October 24, 1923. Upon the reorganization of the operating department. Mr. Garrigues was appointed superintendent of the Cleveland and Pittsburgh division at Cleveland, Ohio, on January 16, 1924. He became general superintendent of the Eastern Pennsylvania division at Harrisburg, Pa., on January 1, 1926, being

Henry H. Garrigues

transferred to the Central Pennsylvania division at Williamsport, Pa., on July 1, 1933, the position he held until his recent appointment as chief engineer maintenance of way of the Eastern region.

Track

A. L. Kleine, assistant engineer of track of the Denver & Rio Grande Western, with headquarters at Denver, Colo., has been appointed assistant roadmaster at Grand Junction, Colo.

Alexander Watling, whose appointment as acting roadmaster on the Canadian National, with headquarters at Prince Albert, Sask., was announced in the May issue, has been promoted to roadmaster, with the same headquarters.

H. Lynn Locke, assistant supervisor of track on the Reading, with headquarters at Reading, Pa., has been promoted to supervisor of track at West Milton, Pa., succeeding **H. F. Smith,** who has been transferred to Tamaqua, Pa.

James Kiloran, track inspector on the Great Northern at Minneapolis, Minn., has been promoted to district roadmaster, with headquarters at Breckenridge, Minn., succeeding **Fred McCarty,** whose death on April 24, is announced elsewhere in these columns.

John Carbone, track supervisor on the Chicago, Burlington & Quincy, with headquarters at Chicago, has been promoted to roadmaster, with the same headquarters, succeeding **Elzear J. Brown,** whose promotion to district engineer of maintenance of way, with headquarters at Galesburg, Ill., is announced elsewhere in these columns.

George W. Williams, assistant roadmaster on the Chicago, Rock Island & Pacific at Armourdale, Kan., has been promoted to roadmaster, with headquarters at Pratt, Kan., succeeding **G. A. Gunderson,** whose promotion to district maintenance engineer, with headquarters at Kansas City, Mo., is announced elsewhere in these columns.

George L. Teyro, supervisor of track on the First and Fifth districts of the Minneapolis & St. Louis, with headquarters at Hopkins, Minn., has been promoted to general roadmaster, with headquarters at Cedar Lake shops, Minneapolis, Minn., a newly created position, and **P. Shaw,** supervisor of track on the Third and Fourth districts, with headquarters at Fort Dodge, Iowa, has been transferred to Hopkins, Minn., succeeding Mr. Teyro. **B. C. Fairchild,** section foreman at Martinsburg, Iowa, has been advanced to track supervisor, with headquarters at Fort Dodge, replacing Mr. Shaw.

John W. Fulk, whose promotion to track supervisor of the Columbia and Greenville line of the Columbia division of the Southern, with headquarters at Greenwood, S. C., was announced in the May issue, was born on August 18, 1902, at Granite Quarry, N. C., and after a public school education he continued his studies by means of correspondence courses. Mr. Fulk entered the service of the Southern on June 6, 1921, as a section laborer, and on November 1, 1921, he was advanced to section foreman, holding this position until his recent promotion to track supervisor, which became effective on April 1.

Elmer A. Eastin, whose promotion to supervisor of track on the Chesapeake & Ohio, with headquarters at Peru, Ind., was announced in the May issue, was born at Muncie, Ind., on October 23, 1902, and entered railway service on the C. & O. on August 1, 1916, as a section laborer. On April 5, 1923, he was promoted to hoist engineer and later to ditcher engineer. On October 16, 1924, he was advanced to assistant section foreman and four years later he was promoted to section foreman. Mr. Eastin was appointed an assistant extra force foreman in February, 1932, and on June 4, 1935, he was advanced to extra force foreman. His promotion to supervisor of track of the Chicago district of the Chicago division was effective April 16.

J. E. Daily, whose promotion to roadmaster on the Radford division of the Norfolk & Western, with headquarters at Roanoke, Va., was announced in the May issue, was born on July 29, 1909, at Richlands, Va., and received his higher education at Virginia Polytechnic Institute. He obtained his first railway experience with the Norfolk & Western during summer vacations from school, serving as a section laborer. On graduating from college he returned to this company as an extra gang laborer, serving in this capacity until October 19, 1936, when he was made a relief section foreman. Two months later he was appointed section foreman at Hangar, Va., where he remained until June 25, 1937, when he was promoted to assistant roadmaster, in which capacity he served successively at Weller Yard, Va., Pulaski, Va., and Portsmouth, Ohio, being located at the latter point at the time of his recent appointment as roadmaster, which was effective on April 1.

Erwin P. Adams, whose promotion to supervisor of track on the Wilkes-Barre division of the Pennsylvania, with headquarters at Reading, Pa., was announced in the May issue, was born on June 18, 1909, at Meadville, Pa., and received his higher education at Pennsylvania State college, graduating in civil engineering in 1932. He entered railway service with the Pennsylvania on October 20, 1933, as a draftsman at Harrisburg, Pa. From February 1, 1934, to April 26 of the same year, he served as an assistant on the engineering corps at Baltimore, Md., then being promoted to assistant supervisor of track, which position he held successively at York, Pa., Baltimore, Md., Harrisburg, Pa., Clayton, Del., and Altoona, Pa. He was located at the latter point at the time of his recent promotion to supervisor of track, effective April 1.

Bascom E. Haley, whose retirement as general roadmaster of the Atlantic Coast Line, with headquarters at Lakeland, Fla., was announced in the April issue, had been in the service of this company continuously for 35 years. He was born on August 5, 1878, at Dalton, N. C., and during the early years of his career he was employed in farming, coal mining, sawmilling and in a printing office and a tobacco factory. In 1901, he entered railway service with the Southern, serving on a bridge gang for the next three years. On March 15, 1904, Mr. Haley entered the service of the Atlantic Coast Line as an assistant bridge foreman, being promoted to bridge foreman two years later and becoming a roadmaster in November, 1910. He held the latter position until January, 1918, when he was promoted to general roadmaster, in which capacity he remained until his retirement in March, 1939. Mr. Haley has been active in the affairs of the Roadmasters and Maintenance of Way Association and served as president during 1936-37.

Bridge and Building

F. B. Robins, assistant engineer in the office of the engineer maintenance of way of the Chesapeake & Ohio, has been appointed assistant general supervisor of bridges and buildings, with headquarters as before at Richmond, Va.

William G. Dorwart, assistant super-

visor of bridges and buildings on the New York division of the Pennsylvania, with headquarters at Jersey City, N. J., has been promoted to master carpenter of the Buffalo division, with headquarters at Buffalo, N. Y., succeeding **J. W. Reed,** who has been transferred to the Pittsburgh division, with headquarters at Pittsburgh, Pa., where he replaces **W. C. Corman,** who has retired. These changes became effective on May 1. Mr. Dorwart was born on July 31, 1907, at Phillipston, Pa., and attended the University of Cincinnati and Purdue university, graduating in civil engineering in 1932. During vacation periods while attending college, he was employed on the Pennsylvania as a maintenance of way apprentice. On October 26, 1933, he returned to the Pennsylvania as an assistant on the engineering corps on the Cleveland division at Cleveland, Ohio, being transferred on March 1, 1934, to the Pittsburgh division at Derry, Pa. About a month later Mr. Dorwart was advanced to assistant supervisor of track on the Buffalo division, with headquarters at Buffalo, N. Y., and after a short time he was transferred to the Eastern division, with headquarters at Alliance, Ohio. On January 1, 1936, Mr. Dorwart was appointed assistant supervisor of bridges and buildings on the Panhandle division, with headquarters at Steubenville, Ohio, and on January 6, 1937, he was transferred to the New York division, with headquarters at Jersey City, where he was located at the time of his recent promotion to master carpenter.

Obituary

Thomas H. White, who retired in 1922 as chief engineer of construction of the Western lines of the Canadian National, with headquarters at Vancouver, B. C., died at that point on March 20, at the age of 92. Mr. White was active for many years in early construction on the Canadian Pacific and the Canadian National.

Fred McCarty, district roadmaster of the Great Northern, with headquarters at Breckenridge, Minn., was killed instantaneously in an accident near Casselton, N. D., on April 24, when his motor car was struck by an automobile at a grade crossing. Mr. McCarty was born on June 1, 1886, and entered the service of the Great Northern on November 1, 1915, as a bridge carpenter on the Dakota division. On June 1, 1920, he was promoted to section forman on that division and served as a section and extra gang foreman until October 1, 1923, when he was advanced to district roadmaster.

John E. Kissell, division engineer on the Cleveland, Cincinnati, Chicago & St. Louis (Big Four), with headquarters at Bellefontaine, Ohio, died suddenly at that point on May 8. Mr. Kissell was born at Springfield, Ohio, on June 14, 1884, and graduated from Ohio State University in 1907. He entered railway service on the Big Four in June, 1907, and later became an assistant engineer in the engineering corps of the maintenance of way department. In 1912, he was promoted to special engineer to the general manager and the chief engineer, and two years later he was advanced to engineer maintenance of way, with headquarters at Mt. Carmel, Ill. In the summer of 1925, when the positions of engineer maintenance of way were abolished, his title was changed to division engineer and he was transferred to Galion, Ohio. Four years later he was transferred to Bellefontaine, where he was stationed until his death.

William Hobbs Chadbourn, Jr., former chief engineer of the Chicago Great Western, died of a heart attack at his home at North Egremont, Mass., on April 16. Mr. Chadbourn was born at Nashville, Tenn., on October 17, 1865, and graduated in 1886 from the Massachusetts Institute of Technology. He entered railway service shortly thereafter and was later employed in a minor capacity on the construction of the Chicago Great Western. He later served in the engineering departments of the Atlantic Coast Line, and Wilmington Seacoast, and in the engineering corps of the U. S. Army. In the fall of 1906, he was appointed chief engineer of the Chicago Great Western and in November, 1909, he was appointed principal assistant engineer. He left the Great Western a few months later to accept an engineering position in the East. In 1915, he became associated with Herbert Hoover in the administration of American relief work in Belgium and northern France, and later was decorated by King Albert and by the government of France.

Homer L. Hunter, office engineer of the Eastern lines of the Atchison, Topeka & Santa Fe, with headquarters at Topeka, Kan., whose death on March 23, was announced in the May issue, was born at Lyons, Kan., on February 24, 1881, and graduated from the University of Kansas in 1909. He entered the service of the Santa Fe on August 8, 1909, as a chainman in the engineering corps at Chanute, Kan., and the following month he was promoted to rodman. In September, 1911, he was appointed a draftsman at Topeka and on August 17, 1914, he was promoted to transitman. Mr. Hunter was advanced to office engineer at Chillicothe, Ill., on June 6, 1917, and on January 1, 1918, he was promoted to division engineer at that point. He was appointed office engineer at Chillicothe in March, 1919, and in May, 1919, he was transferred to Topeka. Mr. Hunter was promoted to division engineer at Chillicothe again on March 1, 1921, and on April 15, 1923, he was appointed office engineer in the office of the chief engineer, Eastern lines, at Topeka, the position he held until his death.

Supply Trade News

General

J. L. Young, general manager of the **Drainage Engineering Company,** with headquarters at Middletown, Ohio, and **W. P. Greenawalt,** district manager, **Ingot Iron Railway Products Company,** at Chicago, resigned their positions with these companies, effective May 1, to organize the **Young & Greenawalt Company,** Chicago, which will engage in general railway contracting and sale of supplies.

A group headed by Roswell C. Tripp and S. DiGiorgio have purchased the assets of the General British Guiana Corporation, Ltd., of British Guiana, and the Greenheart Lumber Co., Inc., of New York, and have incorporated the **Greenheart Lumber Company, Inc.,** of Delaware, with offices located at 70 Wall Street, New York City. Officers of the new company are **Roswell C. Tripp,** chairman; **S. DiGiorgio,** president; **Arturo Antolini,** vice-president; and **H. R. Sabine,** treasurer. Directors include B. L. Allen, R. C. Tripp, S. DiGiorgio, Philip DiGiorgio, and Matthew Robinson.

The United States Steel Corporation of Delaware will open an executive office in Chicago and **G. Cook Kimball,** executive vice-president of the Carnegie-Illinois Steel Corporation, has been elected executive vice-president of the United States Steel Corporation at Chicago, in charge of all operating subsidiaries of United States Steel in this area. The opening of

G. Cook Kimball

the new Chicago office is in recognition of the importance of the Chicago area.

Mr. Kimball graduated from Harvard University in 1900, and in the following year entered the steel industry in the engineering department of the American Tin Plate Company at Pittsburgh, Pa. In 1905, he was appointed chief engineer of the American Sheet and Tin Plate Company and held that position until 1931, when he was elected a vice-president of that company. In June, 1932, he was elected vice-president of the Illinois Steel Company, with headquarters at Chicago, and when the Carnegie-Illinois Steel Corporation was formed in 1935, he was made executive vice-president in charge of the Chicago district.

Personal

W. Purdue, consulting engineer of the **Ramapo Ajax** division of the **American Brake Shoe & Foundry Company,** Chicago, retired on May 1, but will continue in an advisory capacity.

H. M. Starrett, treasurer of Fairmont Railway Motors, Inc., with headquarters at Fairmont, Minn., has been elected president to succeed **Harold E. Wade,** whose death on May 10 is announced elsewhere in these columns. The former duties of Mr. Wade will be divided between Mr.

37 PER CENT SAVED on this drainage investment

BEFORE: "Push-ups" like this were a constant source of extra maintenance expense. Because groundwater saturated the roadbed the tracks kept "giving" under the weight of each passing train so that continued ballasting and tamping were required to maintain surface.

AFTER: The same section of track looks like this today —after installing Armco Perforated Pipe to intercept and remove groundwater. Ditches are clean and the roadbed stays firm and dry without extra maintenance. Besides, traffic moves faster and with greater safety than before. And passengers enjoy a smoother ride.

EVERY WEEK for 24 years 5 men had spent an entire day replacing ballast "pushed-out" from beneath this short section of track. For labor alone, this excess maintenance cost the railroad $1010 a year — or a total of more than $24,000 poured into a mud hole without any permanent results.

Now all that waste is ended and money that once went for extra maintenance goes to operating profit. In 1937 a sub-drainage system of 10-inch Armco Perforated Pipe was installed to intercept and remove ground water. Since then, enough money has been saved in maintenance to repay half the installed cost of the pipe. Even more, these savings will continue to accumulate with each passing year of efficient, low-cost service.

You too can reduce maintenance costs and add years to the life of your track and mechanical equipment by installing Armco Perforated Pipe in all unstable areas. Let an Armco drainage engineer help your staff achieve these profitable results. Just address: The Ingot Iron Railway Products Co., Middletown, Ohio, or Berkeley, Calif. District Offices in all Principal Cities.

SAVE TIME AND MONEY with These Other Armco Products

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ARMCO PERFORATED PIPE

A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

Starrett and **W. F. Kasper,** vice-president at Fairmont, Minn.

Foster E. Wortley, manager of **The American Rolling Mill Company's** Cleveland, Ohio district sales office, has been appointed assistant manager of the midwestern sales area. He will have his headquarters at Middletown, Ohio, effective May 16. **Henry L. Woods, Jr.,** who has been attached to the Armco sales office at Detroit, Mich., as a salesman for the past 10 years, has been appointed manager at Cleveland to succeed Mr. Wortley.

H. P. Mee, who retired as vice-president in charge of sales, service and advertising of the Caterpillar Tractor Company, Peoria, Ill., in June, 1937, has been elected executive vice-president of the **Cleveland Tractor Company,** Cleveland, Ohio. Mr. Mee was born in San Francisco, Cal., and after varied experience in several industries he became credit manager and assistant secretary of the C. L. Best Tractor Company in 1920. When this company became a part of the Caterpillar Tractor Company in 1925, Mr. Mee became treasurer of the company, then secretary-treasurer, then vice-president and treasurer, then vice-president in charge of sales and finally vice-president in charge of sales, service and advertising, which latter position he held in 1936 and until his retirement in June, 1937.

Melvin Pattison, president and treasurer of the **Industrial Brownhoist Corporation,** Bay City, Mich., has been elected chairman of the board, and has been succeeded by **Hoyt E. Hayes,** vice-president. **James B. Hayden,** assistant sales manager, has been promoted to sales manager. Mr. Pattison was born in Hudson, Mich., on May 24, 1864, and entered the employ of Cox Brothers, Chicago, as a yard clerk in 1885. He was promoted at various times until he became general superintendent of yards and docks. He resigned from this company in 1900 to become associated with the Brown Hoisting Machinery Company and held successively the positions of sales manager, plant

Melvin Pattison

manager, executive vice-president and president of the Industrial Brownhoist Corporation which absorbed the Brown Hoisting Machinery Company in 1927.

Mr. Hayes was born in Cleveland, Ohio, on February 27, 1890, and graduated in mechanical engineering from Yale University in 1911. Upon graduation he entered the employ of the Brown Hoisting Machinery Company, working in its shops

Hoyt E. Hayes

at Cleveland. As a salesman he served the corporation in Montreal and New York and later in Paris and London. Upon his return to the home office he was placed in charge of the Cleveland and

James B. Hayden

Pittsburgh districts and the company's export business, which position he held until 1934 when he was promoted to vice-president in charge of sales. He was made a director in 1938.

Mr. Hayden was born in Cleveland, Ohio, on June 14, 1876, and has been with the corporation for 39 years. Prior to that time he spent two years with the Walker Manufacturing Company of Cleveland as mechanical engineer. Mr. Hayden entered the employ of the corporation in charge of the mechanical engineering department at Cleveland, and served as engineer and salesman for the corporation until 1934 when he was made assistant sales manager.

Obituary

Charles Neher, district sales manager of **Templeton, Kenly & Co.,** Chicago, with headquarters at Dallas, Tex., died in that city on April 5.

George D. Kirkham, who retired as southern district manager of the **American Steel and Wire Company,** with headquarters at Memphis, Tenn., in 1929, died in Savannah, Ga., on April 22, following an operation.

Lawrence M. Viles, chairman of the **Buda Company,** Harvey, Ill., died of a heart attack in Chicago on April 27. He was born in that city on September 5, 1882, and graduated from Cornell University in 1904. He then entered the employ of the Buda Foundry and Manufacturing Company, now the Buda Company, of which his father was president. After holding various positions he was elected president in 1918 and chairman of the board in 1937.

Harold E. Wade, president and chairman of the board of **Fairmont Railway Motors, Inc.,** Fairmont, Minn., died in that city on May 10, after several months illness. He was taken to a hospital on April 16 critically ill with appendicitis which followed a month's illness with influenza. Mr. Wade was born at Sheldon, Iowa, on October 4, 1888. He attended the University of Minnesota and later served as assistant cashier of the Fairmont National Bank, of which his father was president. In 1913, Mr. Wade entered the employ of the Fairmont Railway Motors, then the Fairmont Gas Engine & Railway Motor Car Company, as purchasing agent. He served in this capacity until he enlisted in the United States navy on June 28, 1918, as a landsman for the quartermaster of aviation in the U. S. Naval reserve. After training at Dunwoody Institute in Minneapolis, he was transferred to a receiving ship at Philadelphia and embarked by way of Quebec on the U. S. S. Beltana. He served at naval air stations at Killingholme, England, and Brest, France, until he returned to the United States on November 24, 1918. Shortly after his discharge from the navy he returned to Fairmont, and in 1919 was made assistant to his father, then president of Fairmont Railway Motors. He served in this capacity until shortly after his father's death on March 3, 1918, when he was elected president of

Harold E. Wade

the company. Mr. Wade took an active part in conservation, the boy scout movement and other civic enterprises. He was mayor of Fairmont from 1925 to 1927 and at the time of his death was president of the Fairmont National Bank.

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"A New Man on the Job"

"Bill, why did you lose that order on the A— Railroad? Was the X— Company's representative a better salesman?"

"Not a bit of it, Boss. I can outsell him any day if I get an even break."

"Well, you had an even break, as you term it, this time, didn't you?"

"I did not. That order was closed before I ever saw this officer."

"The other salesman beat you to him?"

"No, sir, I don't think he's even met him yet."

"What's your explanation, then?"

"He's a new chief engineer, Boss. You recall that Mr. ——, whom you and I have both known for a long time, retired a few weeks ago and this man was brought in from an outlying division to succeed him."

"Yes."

"Well, you've always argued that we didn't need to advertise our product because everybody knew it."

"I still do."

"Well, it isn't true. And that's the trouble here."

"What do you mean?"

"Simply this. That man had been located way out at —— for years and none of our men ever bothered to call on him, so he didn't know anything about us, and when that requisition came in, he instructed the P. A. to buy the X— Company's product."

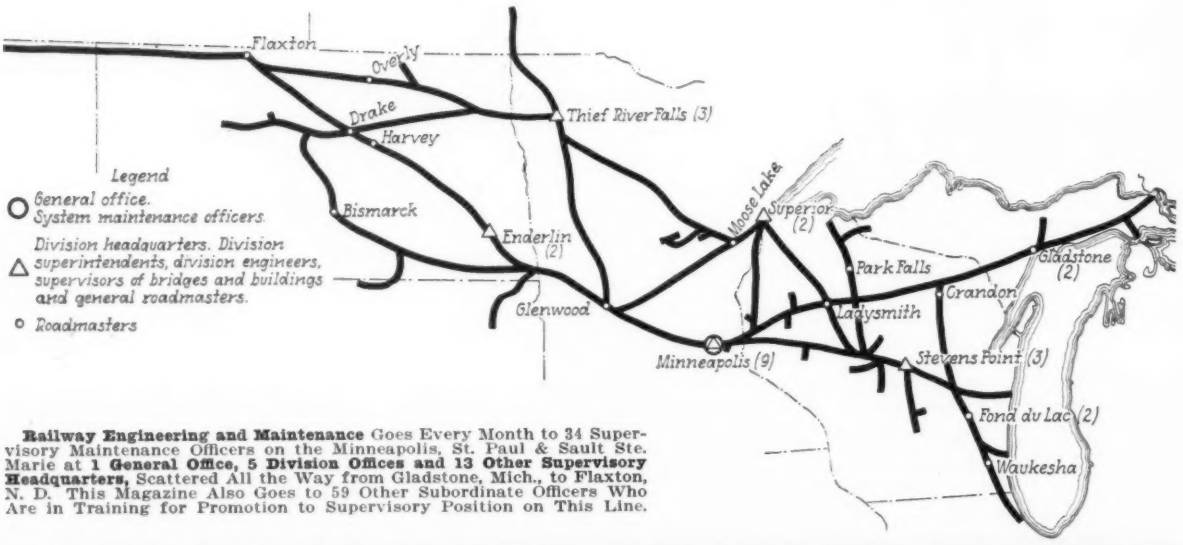
"Well, I will admit that a man here and there might know nothing of our product. But how did this man know of the X— device?"

"Through their advertising in Railway Engineering and Maintenance. They've been telling their story in that magazine for years, and this new chief engineer has read every issue for a long time."

"You mean that we should tell our story there, too, to reach these new men?"

"That's it, Boss. There're a lot of new men in new jobs every year. And don't forget that it's good policy to remind the older men, too."

"I believe you're right. I'll see that we don't get caught in this way again."



Railway Engineering and Maintenance Goes Every Month to 34 Supervisory Maintenance Officers on the Minneapolis, St. Paul & Sault Ste. Marie at **1 General Office, 5 Division Offices and 13 Other Supervisory Headquarters,** Scattered All the Way from Gladstone, Mich., to Flaxton, N. D. This Magazine Also Goes to 59 Other Subordinate Officers Who Are in Training for Promotion to Supervisory Position on This Line.

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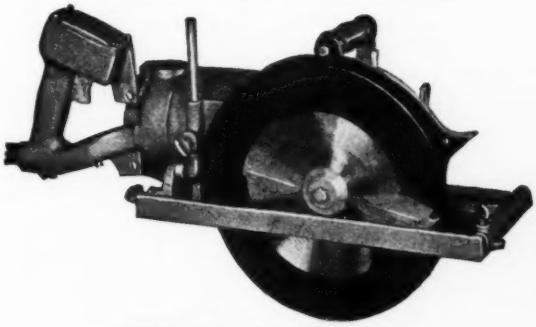

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Railway Track-work Model P-22 Portable Flexible Shaft Grinder for free hand grinding of surface welds, flange ways, switch points and stock rails. Auxiliary attachments include ball bearing hand piece for cup wheel, rocker arm type cross cutter for slotting joints, track drill, etc. The grinder, powered by 4 hp. air cooled gasoline engine or electric motor as desired, has in every respect demonstrated its ruggedness and efficiency on leading railways. Many other models available.

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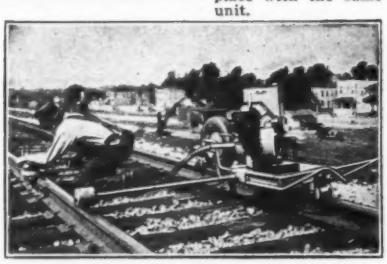

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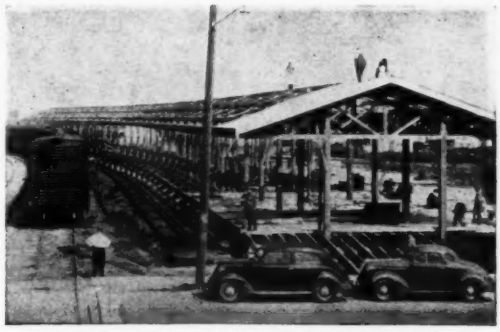

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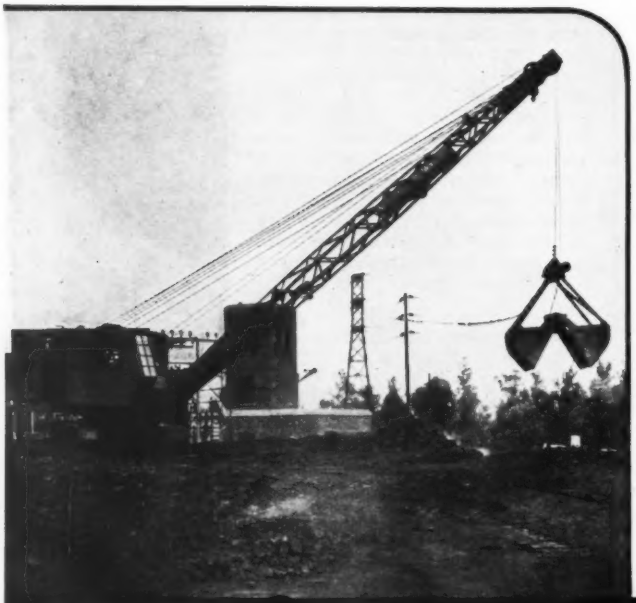

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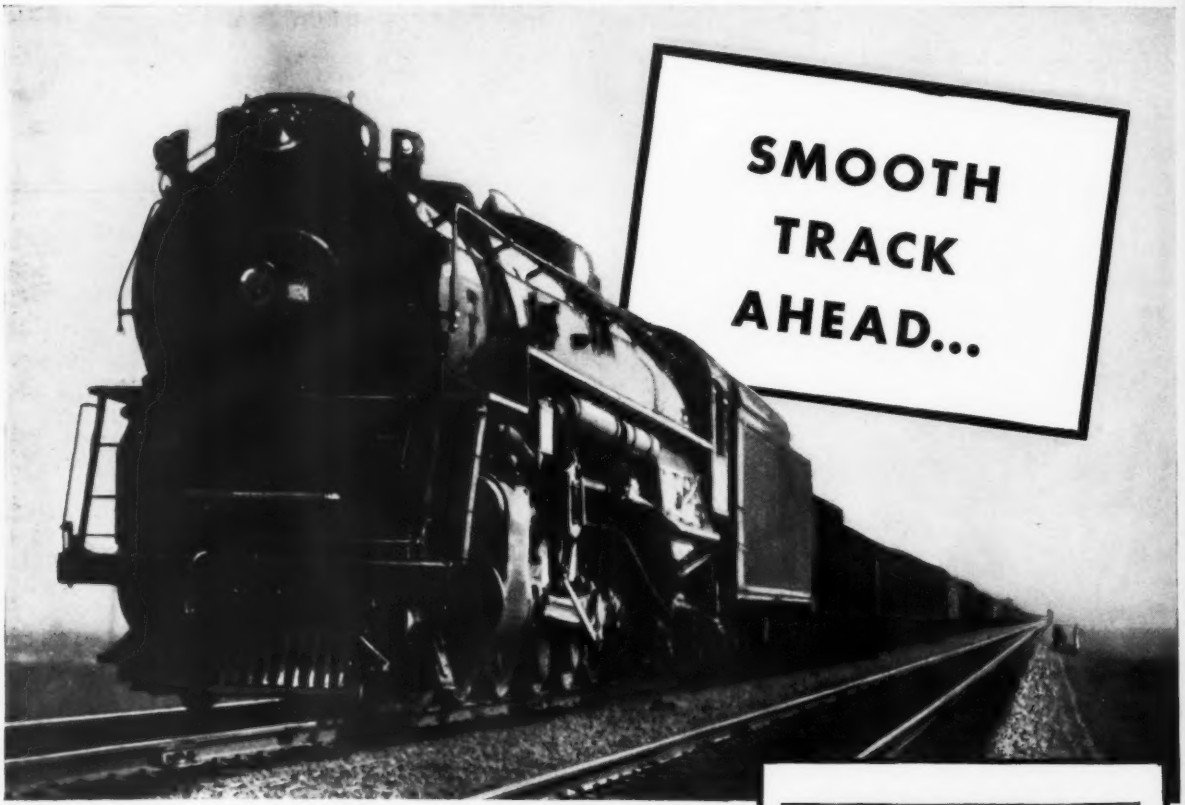

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